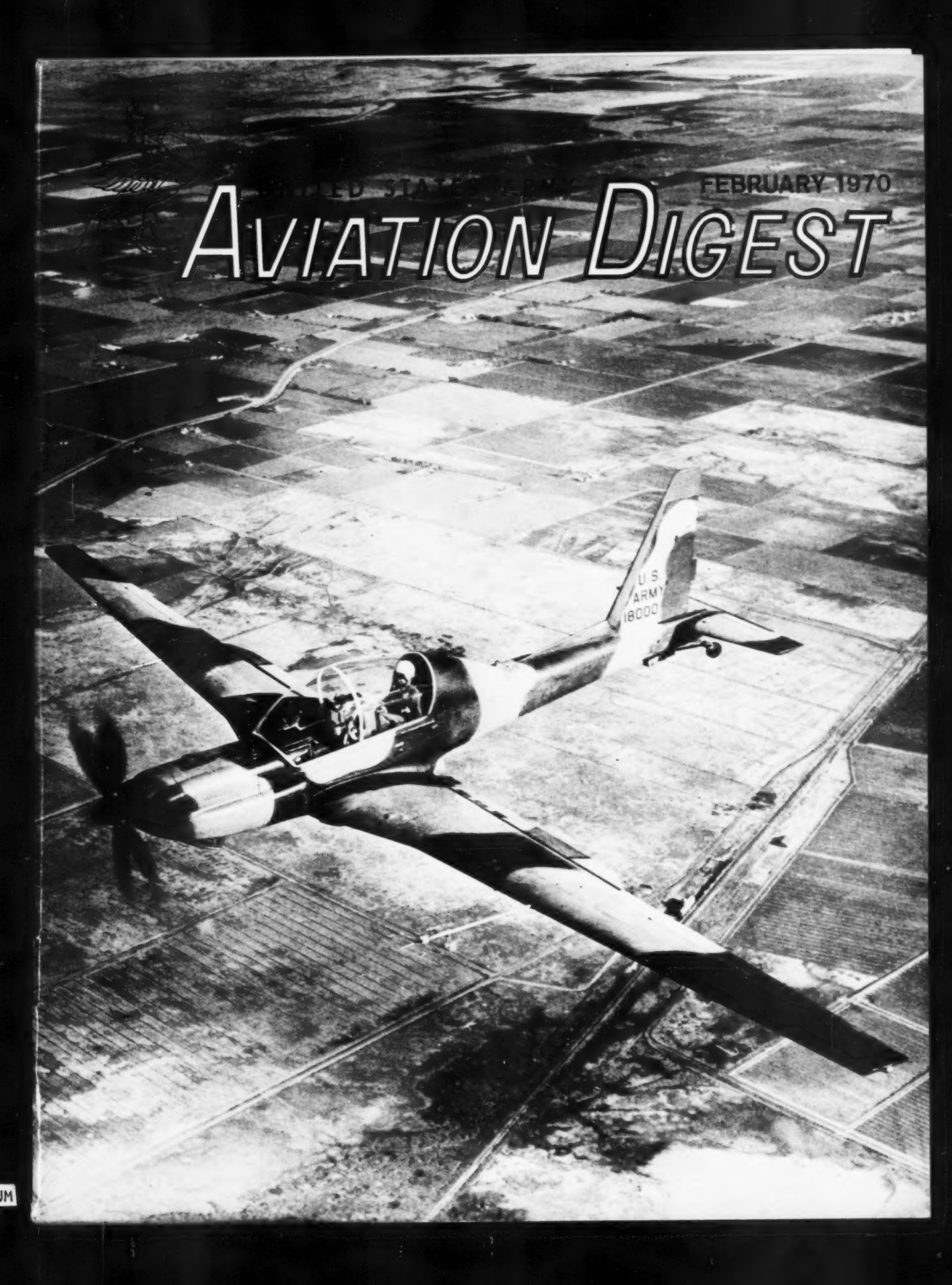
FEBRUARY 1970
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UNITED STATES ARMY AVIATION DIGEST

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ABOUT THE COVER

The YO-3 is flown during an Army Preliminary Evaluation. See "Assignment: AASTA," page 10

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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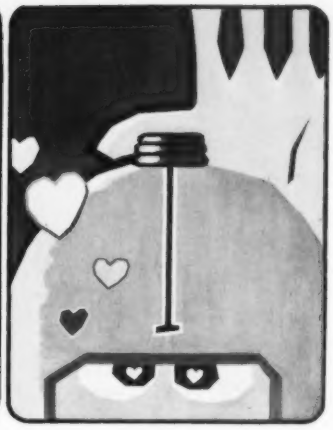
VIEWS FROM READERS



Sir:

Last May the Society of U. S. Army Flight Surgeons was proclaimed by its almost 100 prospective members. The formation of this association was long awaited by the majority of Army flight surgeons, and should come as no surprise to Army aviation whose members have associated in numerous private organizations for many years. The membership duly elected the following officers for the 1969-1970 fiscal year:

President—COL Quitman W. Jones, U. S. Combat Development Command Medical Service Agency, Ft. Sam Houston, Tex.

Vice President/President Elect—LTC James E. Hertzog, Army War College, Carlisle Barracks, Pa.

Secretary—MAJ Nicholas E. Barreca, Department of Aeromedical Education and Training, U. S. Army Aviation School, Ft. Rucker, Ala.

Treasurer—MAJ Stanley C. Knapp, U. S. Army Aeromedical Research Laboratory, Ft. Rucker.

In addition, the remaining members of the board of governors were elected. They are COL Roland H. Shamburek, Office of The Surgeon General, Washington, D. C.; COL Harold R. Chappell, U. S. Army Hospital, Ft. Stewart, Ga.; COL Guthrie L. Turner, Beach Army Hospital, Ft. Wolters, Tex.

To what end does this society address itself? Like most private organizations, its goals are many. Its foremost goal is to effect by its emphasis, a strong continuing contribution through medical support, to the mission of Army aviation, while fostering the mission orientation of its members. Secondary goals include those of identity, fraternity and directivity. Finally, the society wishes to emphasize its youngest members—those supporting Army aviation at its most important level, the unit level.

How will the society achieve its goals? First, by the dissemination of current pertinent professional information to its members. This will be achieved by the publication of its periodical, the AEROMED SUMMARY. The first copy has reached many flight surgeons already. Second, by the publication of professional information to *all* aircrew members and unit flight surgeons. This will be accomplished through regular contributions to the U. S. ARMY AVIATION DIGEST.

The DIGEST has received three articles from the society. The first will appear next month. These articles will be supplemented with additional voluntary quarterly contributions from several Army flight surgeons at Ft. Rucker in the name of the Society of U. S. Army Flight Surgeons.

The society gains support through membership and feedback. All Army flight surgeons desiring membership in the society should request information from the Society of U. S. Army Flight Surgeons, c/o Department of Aeromedical Education and Training, U. S. Army Aviation School, Ft. Rucker, Ala. 36360. All Army flight surgeons (AMOs inherent), having been graduated from an approved course in aviation medicine, will be considered, including those presently assigned to National Guard or reserve units. Regarding feedback, we encourage all aircrew members, as well as flight surgeons, to write us their medical operational problems and experiences.

React to the articles the society publishes. Your reactions can be transmitted to the society by the Editor, AVIATION DIGEST.

Nicholas E. Barreca
MAJ, MC, FS
Secretary

The Evaluation Division, Office of the Director of Instruction, Ft. Rucker, Ala., received the following letter for Charlie and Danny's Write-In and have passed it on to us to answer.

Dear Charlie and Danny:

I need some information about the removal of the accessory drive gearbox on a UH-1D/H.

The instructions given in TM 55-1520-210-20, chapter 5, section II, paragraph 5-73 look simple, but when the gearbox assembly is lowered there is not enough clearance to remove the gearbox. The fireshield, tube assembly for the tail rotor driveshaft is in the way. The only way we can get the required clearance is to raise the engine or to lower the tube assembly.

I would appreciate your help in finding the correct procedure and/or additional information.

CW2 John D. Ryan
4th Avn Det
APO San Francisco 96343

• You will find the answer in TM 55-1520-219-20 (Jan 69) which covers the UH-1B. Look in chapter 5, section II, page 5-60, paragraph 5-91.

Here's what it says: Sub-paragraph h. If engine is installed in helicopter perform the following steps 1 through 4.

(1) Remove starter-generator and N1 tachometer generator.

(2) Remove fuel control.

(3) Lower accessory drive gearbox to gain access to accessory driveshaft.

(4) Using long-nosed pliers, lift accessory drive shaft up to permit movement of gearbox.

TM 55-1520-210-20 does not mention step 4 but that is what you must do to remove the gearbox.

BATTLEFIELD OF THE FUTURE

The U. S. Army has undergone in the Republic of Vietnam a quiet revolution in ground warfare—tactics, techniques and technology. This revolution is not fully understood by many. To date it has received only limited attention. Analysis of the lessons from this revolution will influence the direction of our Army both in fundamental concepts of organization and development of equipment

General William C. Westmoreland
Chief of Staff, U. S. Army

WHEN THE FIRST American units were committed in the Republic of Vietnam they were to a large extent a reflection of the organization, tactics, techniques and technology of World War II, with one noteworthy exception. That exception was best demonstrated by the 1st Air Cavalry Division.

For the first time an Army unit of division size had been organized and equipped to free itself from the constrictions of terrain through the use of battlefield airmobility. The concept and resultant organization of the airmobile division were logical outgrowths of the development of sturdy, reliable helicopters for troops carriers, weapons platforms, command and control, aerial ambulances, reconnaissance vehicles and the development of larger helicopters for carrying artillery, ammunition and supplies. Even before the arrival of American combat troops the effective use of the helicopter had been demonstrated in the support of the Vietnamese.

The enemy we face in Vietnam is naturally elusive and cunning in his use of the dense jungle for concealment. As a result in the early days of the American commitment we found ourselves with an abundance of firepower and mobility, but we were limited in our ability to locate the enemy. We were not quite a giant without eyes, although that allusion had some validity. Whenever we engaged the enemy, we won the battle, but too often those battles were at enemy initiative and not our own. Too many battles were not fought because the enemy could not be found or because, after initial contact, he had slipped elusively into the jungle or across borders politically beyond our reach—or he had literally gone underground.

Since 1965 a principal thrust of our experimentation, adaptation and development in tactics, techniques and technology has been toward improvement of our capability to find the enemy. Each year of the war witnessed substantial improvement. In 1965, 1966, 1967 and early 1968 we increased the number of both air and ground cavalry units. We converted the 101st Airborne into our second airmobile division. As our troops arrived we progressively organized special reconnaissance elements of all kinds including long-range patrol companies and special forces teams. We found ourselves more and more using the infantry for the purpose of finding the enemy. When the enemy broke down into small units, we did likewise. We learned to operate skillfully at night. We mastered the enemy's ambush techniques. Technical means were reinforced and improved. Intelligence organizations were expanded and refined.

During this period the Director of Defense Research and Engineering urged the scientific community to develop a new family of sensors and associated communications equipment to help locate enemy forces on infiltration routes. After proving these devices workable in tests we developed plans in 1967 to use them throughout the battlefield. In mid 1968 our field experiments began. Since then we have integrated these new devices with the more conventional surveillance equipment and other intelligence collection means. As a result our

ability to find the enemy has improved materially.

Comparing the past few years of progress with a forecast of the future produces one conclusion: We are on the threshold of an entirely new battlefield concept. We no longer assign units a sector of frontage. Instead units are responsible for an operational area. And with the mobility of the helicopter, units like the 1st Cavalry and the 101st Airborne Divisions cover hundreds of square miles with their airmobile blankets.

The revolution I envision for the future comes not from the helicopter alone but from systems that heretofore have been unknown.

For a moment let us consider the basic combat role of the Army. As the nation's land force, the Army's mission is to defeat enemy forces in land combat and to gain control of the land and its people. In this role we have traditionally recognized five functions, but we have emphasized only three: mobility, firepower, and command and control. In other words move, shoot and communicate. To me the other two—intelligence and support—have not been sufficiently stressed. Placing the functions in proper perspective I visualize the Army's job in land combat as:

- First, find the enemy.
- Second, destroy the enemy.
- And third, support the forces that perform the other two functions.

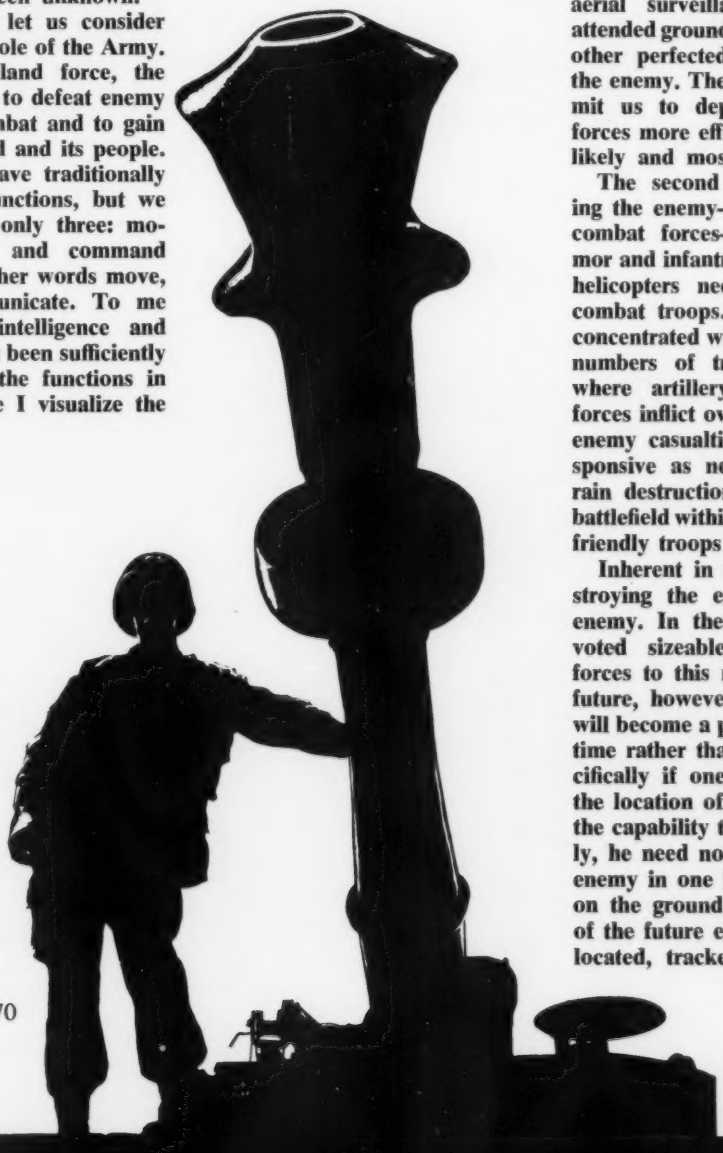
By studying operations in Vietnam one can better understand these functions.

Large parts of the infantry, ground and air cavalry, and aviation are used in what I call "STANO"—surveillance, target acquisition and night observation, or

function number one—finding the enemy. In this function large areas can be covered continuously by aerial surveillance systems, unattended ground sensors, radars and other perfected means of finding the enemy. These systems can permit us to deploy our fires and forces more effectively in the most likely and most productive areas.

The second function—destroying the enemy—is the role of our combat forces—artillery, air, armor and infantry, together with the helicopters needed to move the combat troops. Firepower can be concentrated without massing large numbers of troops. In Vietnam where artillery and tactical air forces inflict over two-thirds of the enemy casualties, firepower is responsive as never before. It can rain destruction anywhere on the battlefield within minutes—whether friendly troops are present or not.

Inherent in the function of destroying the enemy is fixing the enemy. In the past we have devoted sizeable portions of our forces to this requirement. In the future, however, fixing the enemy will become a problem primarily in time rather than space. More specifically if one knows continually the location of his enemy and has the capability to mass fires instantly, he need not necessarily fix the enemy in one location with forces on the ground. On the battlefield of the future enemy forces will be located, tracked and targeted al-



most instantaneously through the use of data links, computer assisted intelligence evaluation and automated fire control. With first round kill probabilities approaching certainty, and with surveillance devices that can continually track the enemy, the need for large forces to fix the opposition physically will be less important.

Although the future portends a more automated battlefield we do visualize a continuing need for highly mobile forces to surround, canalize, block or otherwise maneuver an enemy into the most lucrative target.

The third function includes an improved communication system. This system not only would permit commanders to be continually aware of the entire battlefield panorama down to squad and platoon level, but would permit logistics systems to rely more heavily on air lines of communications.

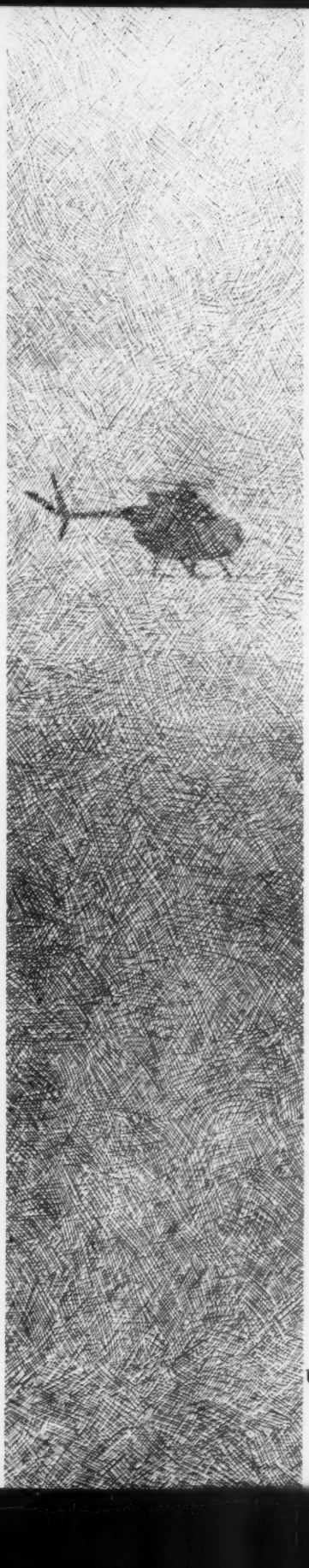
Today machines and technology are permitting economy of manpower on the battlefield as indeed they are in the factory. But the future offers even more possibilities for economy. I am confident the American people expect this country to take full advantage of its technology—to welcome and applaud the developments that will replace wherever possible the man with the machine.

Based on our total battlefield experience and our proven technological capability, I foresee a new battlefield array.

• I see battlefields or combat areas that are under 24 hour real or near real time surveillance of all types.

• I see battlefields on which we can destroy anything we locate through instant communications and the almost instantaneous application of highly lethal firepower.

• I see a continuing need for highly mobile combat forces to assist in fixing and destroying the enemy.



The changed battlefield will dictate that the supporting logistics system also undergo change.

• I see the forward end of the logistics system with mobility equal to that of the supported force.

• I see the elimination of many intermediate support echelons and the use of inventory-in-motion techniques.

• I see some Army forces supported by air—in some instances directly from bases here in the continental United States.

In both the combat and support forces of the future, I see a continuing need for our traditionally highly skilled, well-motivated individual soldier—the soldier who has always responded in time of crisis and the soldier who will accept and meet the challenge of the future.

Currently we have hundreds of surveillance, target acquisition, night observation and information processing systems either in existence, in development or in engineering. These range from field computers to advanced airborne sensors and new night vision devices.

Our problem now is to further our knowledge, exploit our technology, and equally important, to incorporate all these devices into an integrated land combat system.

History has reinforced my conviction that major advances in the art of warfare have grown from the Fullers and Guderians—men who detected in the slow, clumsy, underarmed, largely ineffective tanks of World War I the seeds of the future. Between the two World Wars they foresaw with clarity the blitzkrieg of armored and panzer forces that introduced a new dimension to ground warfare.

Vital intelligence is gained through the use of visual reconnaissance from both fixed-wing and rotary-wing aircraft. At left an OH-6A Cayuse inspects jungle foliage

More recently Generals Hamiltan H. Howze, Earle G. Wheeler and the late Lieutenant General William B. Bunker conceived airmobility long before the machinery existed to fulfill the concept. Today we witness both the airmobile concept and the airmobile division proved in Vietnam.

We are confident that, from our early solutions to the problem of finding the enemy, in Vietnam the evidence is present to visualize this battlefield of the future—a battlefield that will dictate organizations and techniques radically different from those we have now.

In summary I see an Army built into and around an integrated area control system that exploits the advanced technology of communications, sensors, fire direction and the required automatic data processing—a system that is sensitive to the dynamics of the ever-changing battlefield—a system that materially assists the tactical com-

Modern advances in ground warfare, such as the starlight scope below, have provided the ground soldier with equipment to make his job easier, but have failed to replace him altogether. Electronic surveillance equipment can locate the enemy, but the foot soldier inevitably must finish the job of capturing or destroying him. The Army of the future will have a continuing need for highly mobile combat forces.

Troops disembark from a CH-47 Chinook

mander in making sound and timely decisions.

To achieve this concept of our future Army, we have established at the Department of Army Staff level a Systems Manager, Brigadier General William B. Fulton, to coordinate all Army activities in this field. We have done this because of problem complexity. We are dealing with systems that are fundamental to the Army—its doctrine, its organization and its equipment. We are on the threshold for the first time of achieving maximum utilization of both our firepower and our mobility. In order to succeed in this effort we need the scientific and engineering support of both the military and the industrial communities.

To complement the systems management we are establishing at Ft. Hood, Tex., a test facility through which new equipment, new organizations and new techniques can be subjected to experimentation, adaptation, evaluation and integration. This facility will be headed by Major General John Norton who will report to the Project Director, Lieutenant General Beverley E. Powell, III Corps Commander and Commanding General, Ft. Hood.

Hundreds of years were required to achieve the mobility of the armored division. A little over two decades later we had the airmobile division. With cooperative effort no more than 10 years should separate us from the automated battlefield.

Some will say that this is an unrealistic expectation. Some will say that the current experience in Vietnam in which the infantry continues to bear the brunt of combat does not support this visualization of the future. History tells another story. The experience and technology at the time of the British Mark IV tank at Cambrai in 1917 and the H-34 helicopter in the fifties provided the evidence to define the future of these systems.

I believe our future path has been clearly blazed.

AH-1G TRANSITION

The Army's four-week course is in high gear at Hunter AAF

Lieutenant Alan L. Harrison

THE U. S. ARMY Aviation School Element at Hunter Army Airfield, Ga., has been graduating approximately 90 fully qualified AH-1G Cobra pilots monthly.

The only criteria necessary to attend the Cobra Transition/Gunnery Course is that the student be turbine engine, single rotor helicopter qualified. Three general categories of students have attended the course: one, the new Army aviator who has just completed the nine-month rotary wing program; second, the veteran Army aviator returning to the Republic of Vietnam for a second or third tour of duty; and third, the U. S. Marine Corps rotary wing pilot. All three categories of pilots received the same training.

AH-1G Transition

The AH-1G qualification course extends over a four-week period and is divided equally into two phases: transition and gunnery. During this four-week period the student receives 60 hours of academic instruction and 25 hours of flight instruction. Student flying time is 1 hour and 15 minutes per day coupled with 3 hours of classroom instruction. Instructor pilots are trained and assigned to instruct in a particular phase—transition or gunnery—thus, the instructors become true experts in their particular field.

Academic instruction also is divided into two phases, each lasting for a two-week period. The first week of instruction is devoted to the study of preflight procedures, aircraft equipment and the all-important emergency procedures. The second week of academic instruction delves deeply into the inner workings of the Cobra. Electrical systems, hydraulic systems and the power plant are covered in such a detailed manner that the students can detect and correct many discrepancies in the field.

Additionally, the aerodynamic characteristics of the AH-1G are comprehensively covered during the second week. The student is subjected to many new terms such as transient torque effect, the yaw dihedral tendency of the aircraft and pitch cone coupling. These terms are meaningless to the student until he has flown the aircraft and can experience these characteristics.

Let's explain pitch cone coupling. During a recovery from a high speed dive, the rotor blades begin to cone due to the increasing g load being placed upon the system. Due to the built-in capability of the 540 door-hinge rotor system to reduce pitch under these g loading or coning conditions, there will be a gain in rotor rpm accompanied by a loss of torque. Care must therefore be exercised to avoid an overspeed condition. Due to this inherent characteristic of the AH-1G, the pilot must carefully plan his high speed dive recovery as well as the dive itself.

During the third and fourth week of academic instruction, the student receives comprehensive instruction in the weapons systems and attends a class on typical tactics employed in Vietnam. The student is not only instructed on the complexities of the weapons systems and how each is boresighted and installed, but also is taught how to assemble, boresight, arm and disassemble each type.

In Vietnam, armament qualified personnel are not always readily available; therefore, it is a must that AH-1G aviators have a thorough understanding of the highly complex weapons systems.

The first two weeks of flying—the transition phase—are devoted to basic and advanced maneuvers. The basic maneuvers are similar to those performed in the normal flight training conducted during the nine-month initial entry course of instruction in flight school. In addition to all normal stagefield maneuvers, the student is required to have a thorough knowledge of the high speed flight characteristics (120+ knots) of the Cobra. Consequently, high speed work is presented during the advanced maneuvers.

In the first week of the transition phase, the student gets the feel of the aircraft and learns its peculiarities. The Cobra is a tandem-seated aircraft with two stations—the pilot's station, located in the rear, and the gunner's forward station.

The gunner's cockpit has only the minimum essential instruments for flight, with the cyclic mounted on the right hand console and the collective on the left console. During the first two days of flight training the student flies in the gunner's seat for familiarization only.

Since the controls are mounted differently from other helicopters, aircraft control presents a problem for most students for the first hour or two. After two flight periods in the gunner's station, the student moves to the pilot's seat where he receives the bulk of his training in the two-week transition phase.

The remaining time during the first week is spent practicing normal stagefield maneuvers—normal approaches and takeoffs, running landings and takeoffs and the basic autorotational maneuvers. Commencing with the first flight, the student is subjected to the practice of emergency procedures. Preflight and postflight procedures are always stressed very heavily. The student must have a thorough knowledge of all aircraft components in order to detect any discrepancies prior to or after a flight. To complete the course the student must demonstrate a comprehensive knowledge of both the aircraft and emergency procedures.

During the second week of training the student continues all stagefield maneuvers and also begins practicing high speed flight techniques. This represents an extremely valuable part of his training.

One of the peculiarities of the Cobra is the high speed forced landing. This forced landing occurs at airspeeds of 120 knots or greater and presents one of the biggest psychological barriers to the student. He has previously been trained, in the event of an engine failure, to reduce collective pitch first. This technique cannot be followed in the AH-1G. Due to the Stability and Control Augmentation System (SCAS) cor-

recting for the inherent characteristics of the nose of the helicopter to pitch up when power is abruptly decreased, a reduction in collective could result in mast bumping—a disastrous situation in high speed flight.

One night period is flown during the transition phase. This flight is used to familiarize the student with the problems encountered on night approaches, takeoffs and autorotations (demonstrated by the instructor pilot). There are false rumors that the plexiglass bubble is very difficult to see out of at night. If the plexiglass is properly maintained and the lighting on the instrument panel is set to the correct intensity, visibility is good. However, it is difficult to see the intended landing point from the pilot's seat after entering a decelerating attitude. This problem stems from the tandem seating arrangement and the location of the pilot's sight in the rear cockpit.

After successful completion of the transition flight phase and the first two weeks of academics, the student advances into the tactics and gunnery portion of the course.

The tactics phase of training familiarizes the student with the Cobra's full capabilities. The student is taught the many different tactical situations in which the aircraft can be employed and how it handles in various high speed maneuvers.

During one period of the tactics phase each student leads a fire team under varying simulated tactical situations. The students are assigned to a fire team and a team leader is appointed for the first maneuver. The members of the team receive a fire mission. They are given target coordinates, radio call signs and the frequency of the ground unit to be supported. The student leads the team to the appropriate area while the instructor pilot simulates the ground commander. The team leader and the ground commander utilize a preselected frequency so all aircraft involved in the problem may monitor the transmissions.

As the situation develops the team leader supports the ground unit with his fire team, hopefully without help from the instructor pilot. After the mission is completed each fire team meets and critiques each mission performed. The student is reminded that the tactics taught at the school are but one solution and not the only way the Cobra can be successfully employed. Armed helicopter tactics vary from unit to unit and depend largely on the nature of the terrain, the weather, the mission of supported units and the enemy situation.

After the tactical phase of training, the student moves into the gunnery phase. Here he fires the Cobra in its basic weapons configurations: the XM-28 turret, XM-18 minigun pod and the XM-159

Nose view of the AH-1G Cobra

rocket pod. The XM-28 subsystem may consist of either two 7.62 miniguns, two 40 mm grenade launchers or one 40 mm grenade launcher and one 7.62 minigun. The latter XM-28 turret configuration is used at the school and is the configuration most commonly employed in Vietnam. Two 1,500-round XM-18 minigun pods and two XM-159 rockets pods, each capable of carrying 19 2.75-inch rockets, are mounted on the stubby wings of the Cobra. (When mounted on the outboard hardpoints the XM-159C is restricted to 12 rockets.)

For the remainder of the third week and the first half of the fourth week, the student fires the XM-18 miniguns and XM-159 rocket systems. On the third day of the fourth week, he takes a proficiency checkride to determine if he can qualify with the weapons systems. He then returns to the gunner's seat where he fires the XM-28 subsystem for familiarization.

The student also is taught target transition, the technique of changing from one target to another in the same firing run. After the student has completed this satisfactorily, he is instructed to alternate weapons systems while changing targets on the same firing pass.

A gunnery night flight is flown to familiarize the student with night firing difficulties such as target fixation and flash blindness from wing stored weapons.

The many techniques learned during AH-1G transition and gunnery training are not easily acquired. Because of the higher airspeeds, steeper dive angles employed and increased power available, many long, arduous hours of concentrated effort under the close supervision of a well qualified instructor are required to produce a highly skilled, dependable Cobra pilot.

CAUTION!

AH-1G—"Use of full left pedal in making hovering turns to the left or in arresting right turn rates should be avoided . . . "

CAUTION!

CH-47—"Do not shut down the auxiliary power unit until rotor rpm has stabilized in the normal operating range . . . "

Assignment: AASTA

Major Robert F. Forsyth

MAJ Forsyth is a graduate of Union College, Schenectady, N.Y., with a degree in civil engineering. He is a graduate of the U. S. Navy Test Pilot School, Patuxent River. At the time the article was written, he was assigned to the U. S. Army Aviation Systems Test Activity (AASTA), Edwards AFB as the project officer for the CH-47C Airworthiness and Flight Characteristics test

WARNING!

OH-6A—"Upon gound contact avoid abrupt aft cyclic and rapid lowering of collective pitch . . ."

An AH-1G Cobra undergoes a high altitude tethered hover during evaluation with a tractor tail rotor. The test is at Coyote Flats, Calif., near Edwards AFB. Examples of knowledge gained during engineering flight tests of various Army aircraft were extracted from operator's manuals (opposite page)

WHAT DOES engineering flight testing mean to the average Army aviator? Many envision a dashing test pilot climbing the aircraft to its maximum altitude, then diving to maximum obtainable velocity and pulling up as rapidly as possible to see if the wings will stay on, a la Errol Flynn. Nothing could be further from the truth. Nothing at all.

For a real insight into military engineering flight testing it is first necessary to take a brief look at the history of engineering flight testing in the U. S. Army.

During the 1950s, all developmental flight testing of Army aircraft was the responsibility of the U. S. Air Force and was conducted at Edwards Air Force Base, Calif. Army aviation engineering flight testing, as we know it today, began with the establishment of the U. S. Army Aviation Test Office at Edwards AFB in 1960. Three years later the office was expanded in size and the name changed to the U. S. Army Aviation Test Activity. Recent develop-

Assignment: AASTA

ments within the U. S. Army Materiel Command (AMC) and the U. S. Army Aviation Systems Command (AVSCOM) have lead to an expansion of the mission and redesignation of the activity as the U. S. Army Aviation Systems Test Activity (AASTA).

AASTA is not to be confused with the U. S. Army Aviation Test Board, Ft. Rucker, Ala., or the U. S. Army Electronics Command, Ft. Monmouth, N. J., whose missions are separate from those of AASTA. The Army's test mission at Edwards AFB is to—

- plan, conduct and report engineering flight tests of new aircraft systems, research aircraft and existing aircraft systems which have had major component modifications.
- perform other aircraft engineering oriented investigations as directed.

Who are the people involved in the AASTA flight test program? Basically they are divided into four categories: military or civilian aeronautical engineers or engineers of related fields with bachelor's or master's degrees, the experimental test aircraft mechanics, the instrumentation technicians and the test pilots.

With full acknowledgment of the vital support rendered by engineering, maintenance and instrumentation personnel, the following comments will be from the point of view of an engineering test pilot.

All engineering test pilots at AASTA are graduates of one of three of the free world's four accredited test flight training schools: the U. S. Navy Test Pilot School, Patuxent River, Md., which trains most of the Army's test pilots; the U. S. Air Force Aerospace Research Pilot School, Edwards AFB, Calif.; and the Empire Test Pilot School, Boscombe Down, United Kingdom (for the curious, the fourth school is located in France).

Regardless of the school, all test pilots have received both academic and flight test training in jet and reciprocating engine fixed wing and rotary wing aircraft. Periods of instruction vary from 10 months to one year, depending upon the school.

After completion of schooling a pilot usually is assigned to AASTA, with high hopes of a three-year stabilized tour. His first assignment will normally be as project pilot assisting a test pilot project officer in conducting a test program. As he gains experience his duties and responsibilities expand until the day when he also assumes the du-

Below: The CH-47A gunship version of the Chinook series undergoes a stores jettison test over the Mojave Desert in California. Right: A prototype of the YO-3 observation airplane is flown by one of the pilots from the U. S. Army Aviation Systems Test Activity during an Army preliminary evaluation at Moffett Naval Air Station, Calif.

ties and responsibilities of a project officer.

Now, for a closer look at engineering flight testing itself. There are many types in which the military test pilot finds himself involved at AASTA. He may be called upon to monitor contractor flight tests of prototype equipment, to insure that the aircraft is safe for further testing and that the components essential for flight are satisfactory. He may conduct preliminary evaluations called Army Preliminary Evaluation (APE) testing. These tests are conducted by the Army on prototype models in the early stages of development to determine major discrepancies in flying qualities and performance, to establish the degree of contract compliance and to determine if the aircraft are capable of performing their intended mission.

The most comprehensive test performed, however, is the Airworthiness and Flight Characteristics (A&FC) test. This is conducted on production aircraft to obtain final verification of compliance with requirements of the detail specification and applicable military specifications. It also provides detailed information on stability and control, performance, handling characteristics and the feasibility of operational techniques for inclusion in various technical manuals.

In addition to these tests, there are programs of a smaller scope for determining equipment suitability and for developmental testing of proposed aircraft modifications.

The operational pilot sees the results of all these tests in new and improved equipment and in data contained in the operator's manual. Examples are the range and endurance charts or tables, the airspeed system calibration chart, the charts for best climb and descent airspeeds, autorotational airspeeds, height-velocity diagrams and the various caution and warning notations in the operator's handbook.

How is the flight test program for a particular aircraft developed? The first step is designation of the test team consisting of the project officer, test pilot or pilots, test engineers, engineering assistants and instrumentation and maintenance personnel.

The project officer and engineer are responsible for formulating a test plan based on the guidance obtained from AVSCOM. Next, the test aircraft is received and goes into a period of instrumentation for measurement of the various areas of interest in the program.

Actual flight testing is divided into two general categories: the performance tests and the stability and control tests. These results are compiled in the form of oscillograph records, photopanel data and kneeboard notes. Much of the data is processed by computers (an indispensable tool to the flight test engineer) after which it is plotted and analyzed by the project officer and project engineer.

The purpose of all this work is to publish an engineering flight test report which presents, discusses, evaluates and concludes the quantitative data as well as the qualitative data obtained during the test program. The reports are reviewed at AVSCOM and AMC and decisions are made, based in part on the recommendations of AASTA, whether or not to accept, modify or reject a given aircraft or aircraft system.

Thus, it is readily apparent why test reports receive thorough review and analysis prior to being distributed to other government agencies. At the activity the ultimate goal is to insure that the best possible aviation product available is provided our combat units, thus giving them the edge of superior equipment over the enemy.

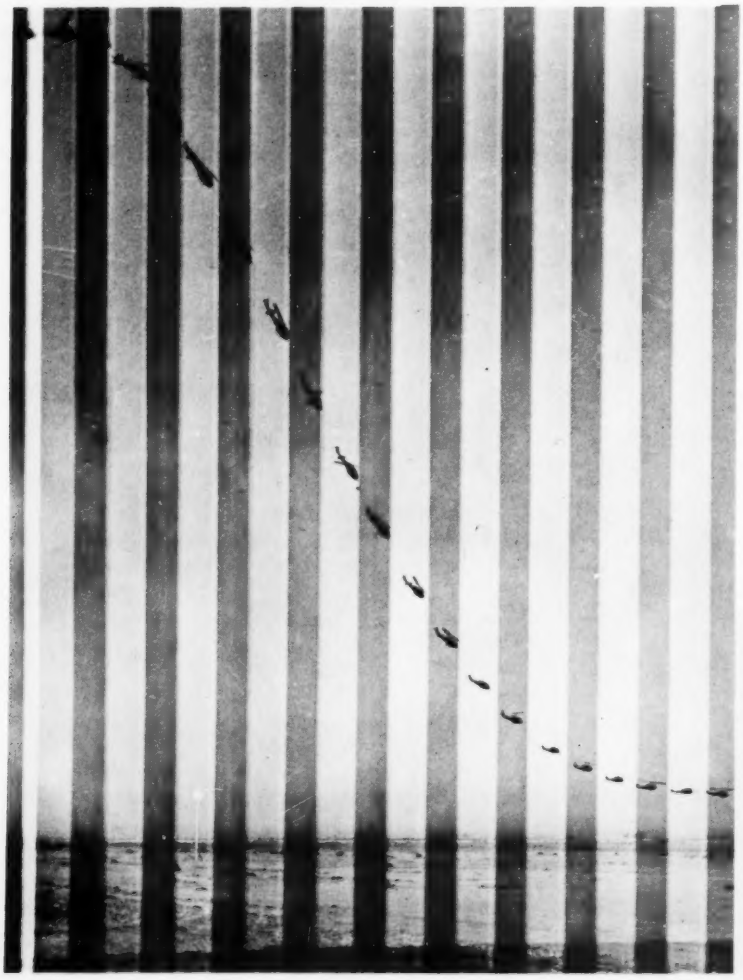
This article would not be complete without some personal comments on the profession of engineering flight testing. It certainly isn't the glamorous occupation many outsiders think it is. However, the work is extremely interesting and test results often are unpredictable. The types of flying are varied, consisting of performance and stability and control at low, medium and high altitudes.

Performance flying is demanding in that precise values of airspeed, altitude, heading or rate of climb or descent are required for extended periods of time.

Stability and control flying is demanding in that the response of the aircraft to various control inputs or to external disturbances must be analyzed in detail for clues to unsatisfactory characteristics.

Dangers and hazards which often are attributed to military engineering flight testing really are overexaggerated. Buildup programs, where critical portions of the test program are gradually approached, are used whenever a potential hazard is known or suspected, thus assuring that no hairy surprises occur.

Temporary duty assignments are a necessary evil of the business and probably are the least attractive facet of testing—especially to the wives of test personnel. These TDY assignments are required to obtain special test conditions not available at Edwards AFB such as sea level, high altitude and cold temperature environments or to



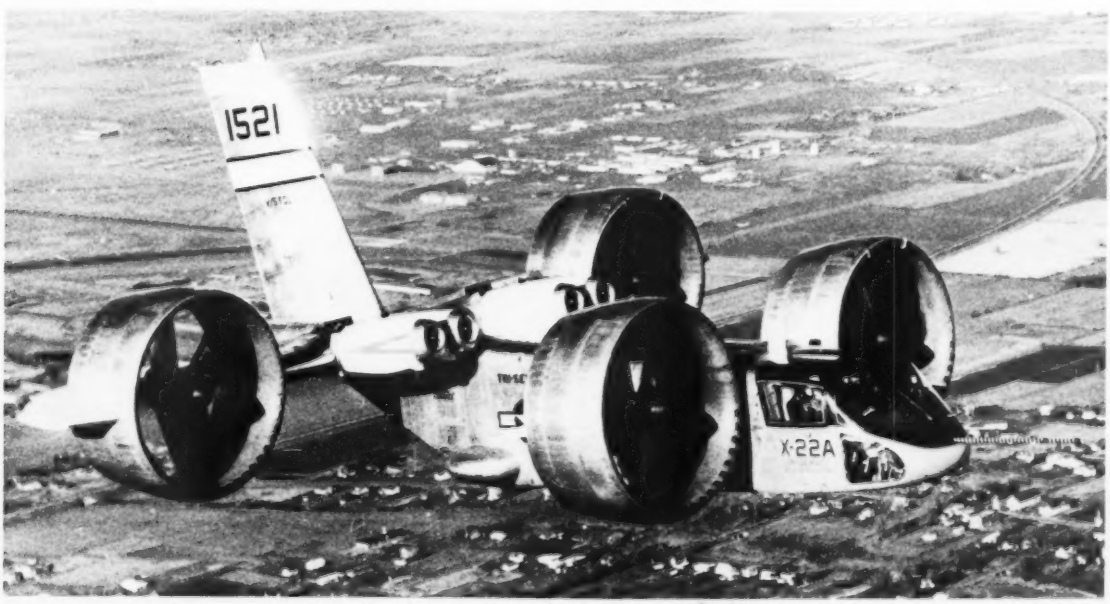
Left: A height-velocity test of a UH-1C Huey was photographed with a Fairchild Flight-Path Analyzer Camera. Above right: A CH-47B Chinook prepares to touch down during a high altitude height velocity investigation at Lake Tahoe, Calif. Engineering flight tests continue through the winter months. Another aspect of the U. S. Army Aviation Systems Test Activities engineering flight test is the tri-service evaluation of such aircraft as this X-22A V/STOL research aircraft (right)

conduct tests at contractor facilities and other governmental test sites.

How can one become a test pilot? The requirements are contained in DA Circular 350-77, but certain other qualities must exist to motivate an aviator to apply for the program. First, he must have the ability and desire to complete a rigorous course of academic and flight instruction. This is where an engineering background comes in handy. He must be willing to investigate an aircraft with patience and a determination to remain objective. Finally, he must be a person who is critically alert to the peculiarities of the aircraft he is testing.

The job is not one in which flying time is rapidly acquired. It is one in which a pilot can see, in a relatively short period of time, changes effected in an aircraft, aircraft subsystem or operational technique which benefits the operational unit.

The field is necessarily selective, but for those who qualify, it is a fascinating career.



Charlie and

Dear Charlie: Why not change step 10, page N-10 of the OH-6 dash CL to position the air filter scavenge switch to off? It appears to me that power will be drained from the engine when hot engine bleed air flows through the inertial particle separator air filter.

CPT L.B.

Charlie's answer: By placing or leaving the scav air switch in the off position, dirt and foreign particles from the inertial particle separator cannot be effectively siphoned overboard. The particle separator serves its purpose only if the switch is in the on position. Any power loss is insignificant especially when compared with the value of eliminating particles in the airflow.

★ ★ ★

Dear Danny: What happened to the go no-go procedure for the UH-1H? I was studying the latest UH-1D/H dash 10 and found the UH-1D go no-go but no placard and instructions for the "H" model.

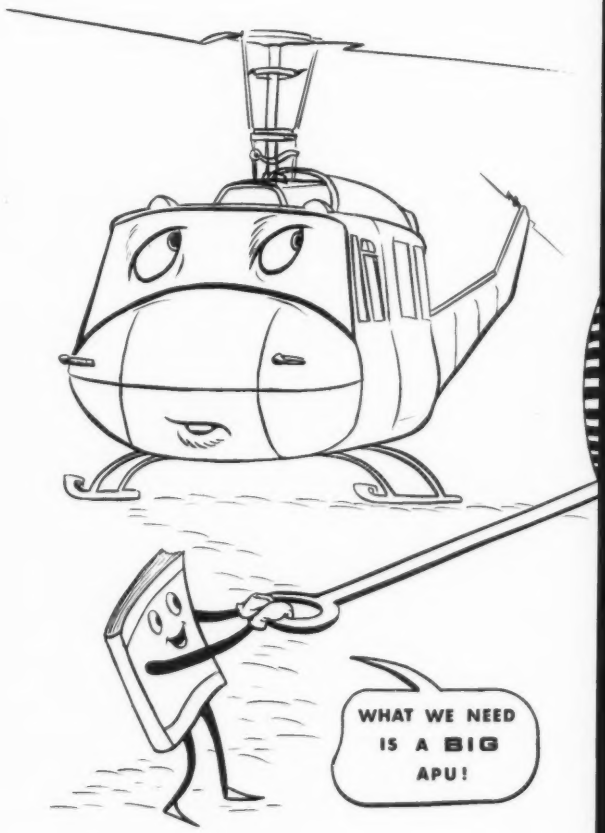
MAJ M. I. F.

Danny's answer: The go no-go procedure is valid for UH-1s with T-53-L-9 and -11 engines only. Because of the torque limit of 50 psi for the UH-1H, the go no-go procedure is not always reliable for the L-13 engine. For example in a hover check for takeoff in a UH-1H the pilot could determine a go condition when he had the reserve 2 percent N_1 required for climbout from a confined area. If the torquemeter was indicating approximately 50 psi during this check, the torque limit (50 psi) would be exceeded when the additional 2 percent N_1 is applied for takeoff.

★ ★ ★

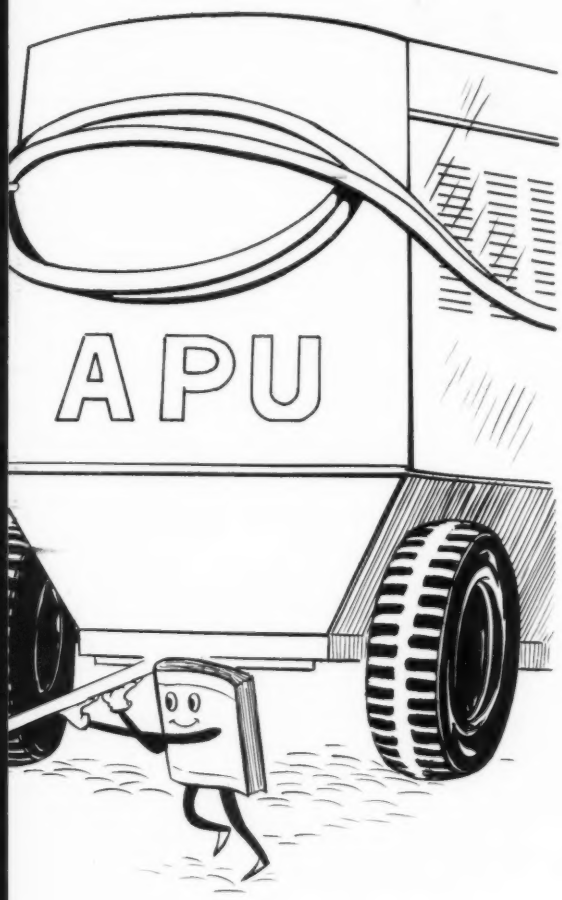
Dear Danny: I'm still confused about the amount of amperage required for starting the UH-1 with an APU. I read your comment in the November issue of the AVIATION DIGEST but since then I got the word from maintenance that 300 to 350 amp APUs do the job. Has this changed again?

CW3 J. F. F.



Danny's answer: We've had a couple of phone calls concerning this same subject. Here's hoping that this helps to eliminate the confusion. The initial power surge required for starting UH-1 helicopters is approximately 650 amps. The amperage requirement for the remainder of the start is 300 to 350 amps. This means that the 7.5 kw APUs in the Army inventory need an additional 300 to 350 amps beyond their 300 amps output. This additional amperage can be supplied by a fresh 24 volt battery. If the battery is not sufficiently charged it is very doubtful that the APU will accommodate the UH-1

Danny's Write-In



Dear Danny: Reference: TM 55-1520-221-10 (AH-1G) change 3, dated 7 Aug 69, page 12-8. As indicated in the above referenced manual and page, the maximum inboard stores load is 670 pounds. Note 3a, same page, authorizes a full load of 19 XM-229 rockets on the inboard stores. On page 12-8D the weight of these 19 rockets is shown as 682 pounds. Request clarification as to which limit is correct.

1LT R. L. S.

Danny's answer: You have the eyes of an eagle. And would you believe that page 12-8 of the Cobra manual shows the wrong weight for maximum inboard stores load. The correct weight is 690 pounds and will be changed in the next revision to the manual.

★ ★ ★

Dear Danny: The dash 10 and dash 20 for the U-8 don't agree on the authorized fuels for that machine. The dash 10 says 115/145 is the *only* authorized fuel but the dash 20 authorizes 100/130 as an alternate. My questions are:

1. Which publication has priority?
2. What grades of fuel are authorized?
3. Is grade 108/135 a suitable alternate?

MAJ A. N. W.

Danny's answer: Thanks for the questions. Neither manual has priority over the other; they should give the same information. Since they differ a change has been submitted to include the following information:

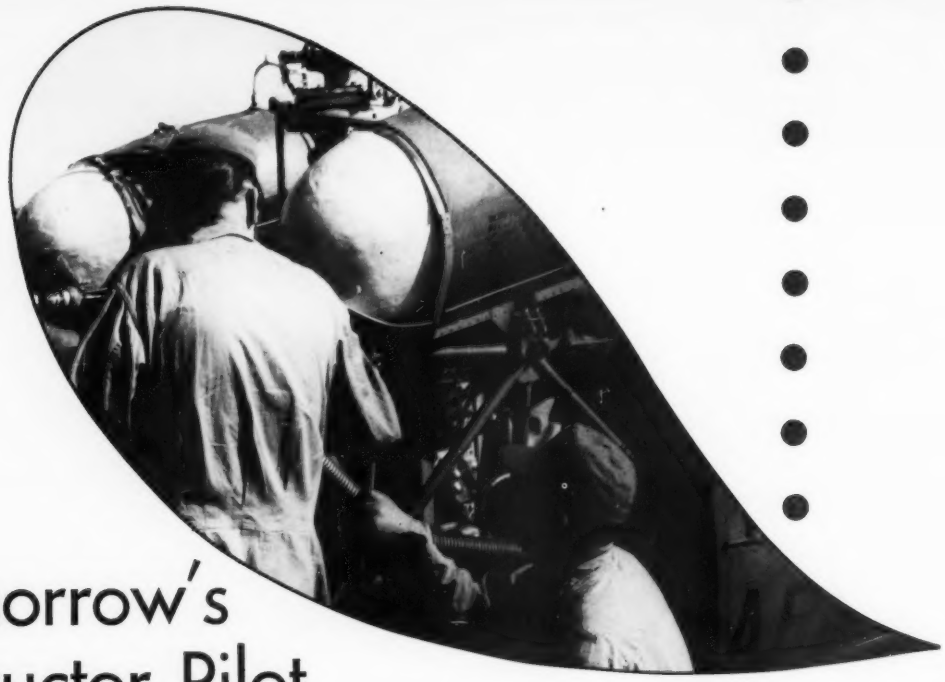
1. **MIL-G-5572, Grade 115/145—Standard fuel.**
2. **MIL-G-5572, Grade 100/130—Alternate fuel.**

Grade 108/135 is a suitable alternate fuel but I sure don't know where you can find any. This grade has been omitted from the manual because we didn't know there was any around. One word of caution—the use of this grade fuel, especially if it is old, may require special operating and maintenance procedures.

★ ★ ★

starting load, particularly during cold weather operations. Until such time as a more adequate 28 VDC APU is available, user units will have to "live with" the existing equipment. There is a note in the latest operator's manual stating that 650 amp APUs should be utilized for starting.

Keep them cards and letters coming to Charlie and Danny's Write-In, ATTN: Evaluation Division, DOI, Ft. Rucker, Ala. 36360. We do appreciate them. A special thanks goes to that nice little old lady from San Antonio who sent us the latest change to the Spad manual.



Tomorrow's Instructor Pilot

A quarter of a century of Army instructing experience has helped to develop better instructor pilot (IP) selection methods and better instruction techniques. Due to these advances, a bright future is dawning for tomorrow's instructor pilot

Major Darryl W. Johnson

LIKE MOST AVIATORS I was somewhat reluctant to accept the fact that my "first pilot" days were numbered and I would eventually become an instructor pilot (IP). Then there was the fateful day when the commander asked in the middle of a staff meeting, "Who's going to be our OH-13 IP now? Johnson, don't you have the most time in 13s?"

So there I was—proud, pleased and petrified! In one fleeting moment the commander's "magic" words of distinction had changed my whole career. I became an IP.

Fortunately I did have a considerable amount of aptitude and interest in teaching which helped to overcome my initial shock reaction. And, with typical egocentric aviator stubbornness (perseverance) I soon learned the truth of that old saying, "If you want to learn a subject, teach it."

In my effort to improve the techniques of others I soon found myself listening, watching and waiting for each student's different set of questions. And, combining all my patience with an honest desire to teach (and countless back-to-the-books searches for answers) I eventually became confident in my new job as an IP.

But tomorrow's IPs will be selected a little more scientifically than I was and will be trained a little more thoroughly before being thrust into the other seat. There

are some types that have lots of aptitude and desire to become instructors, but there are also many fine pilots who have no business trying to teach. A high school diploma is hardly sufficient training to become an English teacher even though most of a student's studies were dependent upon his knowledge of the language. We train pilots to perform the job of rotary wing aviator or fixed wing aviator. It is a small wonder then that the Vietnam returnee has quite a problem adjusting to a new role as a flight instructor after 12 short months on the job.

While a pilot must certainly have a lot of proficiency in flying the aircraft, he is not necessarily required to explain all of his thought processes and physical actions concurrently. It takes quite a bit of analytical ability to convert these complicated mental and physical actions into words, let alone fly the aircraft safely during the translation.

The traditional platform instructor has quite an advantage over the IP. The platform instructor has hours or days to prepare an elaborate lesson plan and is supported by several training aids. The IP must insure that all student errors are specifically identified, explained, demonstrated and corrected as they happen in order to communicate the detailed teaching points in a cockpit.

The IP who does not operate with a complete list of training objectives; does not have any established criteria to measure student performance; does not make systematic decisions in selecting his methods of instruction; and does not analyze his students' performances sufficiently to improve his instructional techniques is not making productive use of the student training time. To help IPs improve their instructional abilities, new techniques are continually being developed.

Better guidance is being formulated to help the rotary wing IP improve his techniques of instruction. The U. S. Army Primary Helicopter School, Ft. Wolters, Tex., has begun programing various flight syllabus lessons within the rotary wing aviator courses. Based upon job oriented training objectives, the programed flight lesson is precisely defined in scope with nearly all of the possible alternatives during the lesson identified as teaching points or test items. Most students should achieve immediate success with their lessons since the periods are short, easily understood and the objectives move from simple to complex requirements. The instructor is able to render a better critique of the lesson because of its short and simple grading elements.

Personality problems, long the bugaboo of flight instruction, will be significantly reduced through an objective appraisal of student proficiency. The guesswork about training objectives will be eliminated and the student should agree with his instructor that the next objective is attainable within a few minutes. The lesson sequence will compel the student to proceed from basic to advanced objectives with minimum deviations. It will be the instructor's role to diagnose the student's strength and weaknesses, prescribe one of the listed teaching situations and offer guidance and encouragement rather than general opinions of overall student performance. The IP will become a manager of student training time, scientifically steering each student through the specific training objectives.

Management of a student pilot's training sounds simple, but if you can recall your own fledgling (presolo) days I am sure you will agree that the daily schedule is plenty complicated from the student's standpoint. The IP must always show a firm hand, yet provide gentle and unerring guidance for his student through the many flights, classes and personal problems in training. Every day is a new experience for the student and must be planned and exploited to the greatest learning advantage possible.

There also is another problem that faces most IPs: there just aren't sufficient training aids and simulators available when he needs them. Since he is most familiar with the cockpit it is obviously most convenient for the IP to present the various teaching points in the aircraft itself. But this is not always the easiest place for a student to learn. Constant distractions are competing for the student's attention. Noise, movement, gauges and dials, levers, vibrations and many other unnecessary confusion factors enter into this teaching environment.

As long as the desired student learning is accomplished, it makes little difference where or how the education came about. Many very fine aids to instruction are becoming available—flight simulators, educational television, films, slides, tapes, etc. And eventually the IP will have all of the different training media readily available to solve the student's learning problem of the moment.

Computer assisted instruction is just around the corner (two to five years) to add greater speed, standardization and individualized student scheduling possibilities for flight instructors. The IPs then may be spending most of their time just monitoring their student's training while the computer does all the work. The new breed of instructors may be teaching less and counseling more.

Tomorrow's generation of instructor pilots are probably going to face the most challenging assignment ever given an IP: to answer those questions that the computer can't!

Maintenance

Foreign Object Damage: One way the 498th Medical Company combatted FOD was to paint a one gallon container red and paint FOD in large white letters on the container. This container was hung on the rotor head. When the crew chiefs and/or maintenance personnel worked on an aircraft all cut safety wire, cotter keys, unserviceable washers, nuts, bolts, screws, etc., were put into the container. The big red container was a continual reminder of FOD and we believe it helped keep foreign object damage in the 498th Medical Company to a minimum.

★ ★ ★

T-53 Compressor Stalls: Several incidents of compressor stall occurred during sustained dusty area operation with UH-1B aircraft equipped with T-53-L-9 and L-11 engines. Inspections disclosed very slight compressor erosion and no FOD. All normal cleaning procedures failed to alleviate the condition. A round table discussion of the problem centered on the bleed band and actuator assembly. Runup and observation of the bleed system disclosed occasionally sluggish operation. Cleaning of the P-3 air screen at the entry to the bleed band actuator and cleaning of the trigger valve assembly (when plunger was depressed the valve was sluggish and would occasionally stick) eliminated what was otherwise an unexplained compressor stall.

★ ★ ★

Will It Start? Place yourself in the following situation. You started your UH-1 with the aid of an auxiliary power unit (APU), flew the first part of your mission and landed in a remote area where you shut down the engine to wait for your passengers. While preparing to shut down you noted that (after the earlier APU start) you failed to turn the battery switch to the ON position. You know that this means your battery was not charged during the flight. With no APU available at your present

Matters...

location, how can you determine if the battery is sufficiently charged to restart the engine after it has been shut down?

The battery charge status (full charge or charging) can be determined prior to engine shutdown by accomplishing the following steps:

- With the battery switch ON, note loadmeter reading.
- With the battery switch OFF, note loadmeter reading.
- Should the loadmeter needle deflect more than one needle width, continue to run the engine until there is less than one needle width deflection. Then the engine may be shut down with the assurance that the battery is fully charged.

★ ★ ★

Shop Safety: It is the responsibility of all personnel in the shop sections to maintain an effective shop safety program. Shop personnel will continually exercise care and caution in the operation of shop equipment.

All spills must be cleaned up immediately to keep hazardous materials such as oil and grease off the floor. Oil pans should be used to help prevent unsafe conditions.

Aisles will be kept free of hazardous obstructions and suitably marked by painting.

Unsafe equipment and fire hazards are the main factors to be observed. Unsafe equipment will be reported immediately. Sparks, friction or careless handling can cause an explosion that will destroy equipment and buildings and injure or kill personnel.

Locate all machines adjacent to sections they support and provide sufficient space for the operator to work.

...you better believe it!

Substantial low resistance conductors will be used to ground all machines. Safety devices such as guards, interlocks, automatic releases and stops must be kept in operating condition.

Suitable mechanical guards such as inclosures or barricades will be permanently installed.

Machinery will not be adjusted, repaired, oiled or cleaned while in operation or power is on. Personnel operating machinery will wear protective clothing as prescribed. Jewelry should not be worn. Make sure that all unauthorized personnel are clear of area; all machinery will be operated by qualified personnel only.

Oily waste, rags and similar combustible materials will be discarded in a self-closing metal container and no flammable materials will be stored in the shop. There will be *No Smoking* signs placed in areas where fires could start easily. All personnel must know the location of the firefighting equipment, how to use it and the different types of fires and how to extinguish them.

Handling tools and materials requires observance of common safety practices such as not leaving tools or objects in elevated positions or pointing a compressed air stream toward any part of the body. Electrical cables and air hoses will be laid out so there is no danger of tripping. Electrical tools must be connected to a low resistance ground.

A clean, well arranged shop is a safe shop.

A Guide For DIGEST Authors

O.K., so you're not Hemmingway. Not everyone can be a professional writer, but everyone should be able to express himself in writing, regardless of his profession. Here's the shove you have needed to get started on your DIGEST article

SAVED ANYONE'S life lately? This question might be more significant than you think. It's just possible that you may possess some knowledge or have benefited from some experience that could save somebody's life—*if* they knew about it. You can tell them in the U. S. ARMY AVIATION DIGEST.

No matter what your job is, there is something about it or something that you have experienced that is of interest to the 500,000 professional people who read the DIGEST each month. You know what is happening and where it is happening and we invite you to share your experiences with others interested in aviation. While it may not necessarily save a life, it could easily save time and money.

The DIGEST continually seeks to keep those involved in Army aviation informed about the most recent advances in aviation safety, operations, maintenance and technology. The magazine also serves as a sounding board for new ideas which further the cause of Army aviation and it promotes esprit de corps by noting significant accomplishments.

You, the reader, can do your share to help make this goal a reality by sharing your knowledge, experiences and ideas through the DIGEST.

This is how to do it. Anyone can submit an article to the DIGEST. When your manuscript is received several things happen. First, you get a letter of acknowledgment; then, if the DIGEST prints the article, a letter crediting you with having had an article published is placed in your 201 file at your branch at Department of the Army. Third, your published article is entered in the monthly award competition. If you win, you receive an engraved plaque plus $25. Also the article becomes eligible along with other monthly winners for the annual awards contest. The three best of the year are selected and the winners receive engraved plaques and cash awards of $250 for the first place article, $150 for second place and $100 for third.

You don't have to be a professional writer to contribute to the DIGEST. Our authors come from all walks of life. Don't worry if your article is not perfect grammatically or does not conform to DIGEST style. The staff will edit the manuscript and correct such errors.

Material submitted to the DIGEST varies from pictures, letters, ideas and suggestions to full articles. Any material that falls within our mission is welcome. However, as an official Department of the Army publication, the DIGEST follows guidelines which limit the publication of certain types of articles. For instance, material which tends to publicize units or individuals for the mere sake of publicity is not printed. If you have any doubt about the acceptability of the item, either send it and let us be the judge or query the DIGEST prior to writing the story.

Whenever possible an author should contact the DIGEST before beginning his article to be sure he is on the right track. This can be done in person, by telephone or by mail. All military personnel, including those in the Republic of Vietnam, are authorized to deal directly with the DIGEST. To insure technical accuracy, manuscripts are reviewed by experts in the particular field with which they deal. For example, a story on helicopters normally would be

reviewed by the Department of Rotary Wing Training at Ft. Rucker, Ala., and an article dealing with aircraft design or modification can be sent to the U. S. Army Aviation Systems Command at St. Louis, Mo. Many articles are reviewed by the Department of the Army to insure compatibility with official government policy and to insure that they do not contain classified information. The author has the option of clearing his story through the Office of the Chief of Information, Headquarters, Department of the Army prior to submission, or he may send the manuscript and let the DIGEST handle the clearance.

These safeguards protect not only the author but also the DIGEST and the government against printing misleading, false or even libelous information. Also, reviewing agencies often improve an article by adding current information that may not be readily available to the author.

"Borrowing" another author's work is not the way to write your DIGEST article. Be sure to express only your own ideas and always give credit to others when you borrow from them

What would we like for you to write about? Anything covered in our mission is suitable. The following topics are offered as suggestions (a more detailed list of suggested topics can be yours upon request):

• Army aviation subjects of timely interest.

• Maintenance, operations, safety, etc., practices that save time, money and material.

Anyone can take a snapshot, but it takes someone who knows his business and who has the equipment to back it up to come up with the photographs that have that professional touch

• New uses for Army aviation or its equipment.

• War stories or personal flight experiences that bring out new or unique tactics, techniques or safety procedures.

• All phases of professionalism in the aviation program.

• Research and development projects.

• Humor, with a teaching point.

• Historical aspects that tend to establish an Army aviation heritage or to build esprit de corps.

• Anything expressing original constructive thought on Army aviation.

In selecting a topic it is generally best to choose one with which you're familiar. If you or someone in your unit has found a new, better or safer way or doing something or has had a personal experience of value to others in the program, write about it.

Once you have made your selection, make an outline of what you want to say. At this point, a

A Guide For DIGEST Authors

visit or call to the DIGEST could make the difference between failure or success. A member of the staff will be able to tell you whether or not such a story would be of value to the DIGEST and how best to proceed from there.

With a firm outline you will find that you won't ramble or omit important points. Keep the average reader in mind. Don't assume that all the readers will understand terms that you use everyday in your job. Identify all such terms in your article.

By having an interesting and attention-getting lead paragraph you will be able to catch the reader's attention and then focus it on what is to follow. Illustrations are important supplements to the written word and will be helpful in holding reader attention throughout the article.

The continuity of the story must be developed from the very beginning and should not be overlooked when the concluding paragraphs are written. If the story doesn't have a surprise ending or a natural conclusion you might try tying the ending back to something mentioned in the lead paragraphs.

Another important item to be aware of, especially when writing about technical subjects, is the accuracy of facts and figures. Although we will check them for accuracy, this detail is really your responsibility. If you are unable to verify statistics, call this to our attention.

Permission must be obtained from copyright owners to reprint quotes of more than 200 words. Plagiarism—an ugly word for stealing another author's original work —could make you, the DIGEST and the government subject to legal action. Be sure to credit your sources if the idea is not solely your own.

Whenever possible include appropriate, captioned photographs, artwork, charts or diagrams to illustrate material. The readability of any article is enhanced by good illustrations. If you are not sure what is needed, send what you have and let us decide what to use. Below are some general guidelines concerning supporting material:

• Use protective cardboard for illustrations during mailing and do not use staples or paper clips on pictures. Use cellophane tape or masking tape to attach captions to the back of the photo.

• We prefer black and white glossy prints or their negatives. We can use color photos but they do not reproduce as well.

DIGEST authors are eligible for the monthly $25 award which is given for the best article. Awards of $250, $150 and $100 are also given for the top three stories of the year

• Get a professional photographer if possible to take the pictures.

• Captions should include the full name and rank of each individual, if known, and a description of what is taking place in the photo.

• Be sure to credit proper sources for illustrations. Obtain written permission to use photos from outside sources, or advise us of ownership so that we may obtain this permission.

We prefer that manuscripts be typed on standard size bond paper —double-spaced. Do not send carbon copies unless you verify that the DIGEST is the only recipient of the article. If you do not have access to a typewriter, we will be happy to receive your handwritten material.

Manuscripts should run from 2,000 to 3,000 words, but we realize that many subjects require a greater or shorter length. The best guidance we can offer is to make the article long enough to tell the story without omitting meaningful information or adding excess wordage that adds little to the effectiveness of the story.

It is important that you send a short biographical sketch to include your rank, a permanent address, current assignment and other information you feel is appropriate. We are especially interested in any significant facts in your background that tend to lend credence to the subject matter about which you write. If you change assignments, address or are promoted before we have printed your article, send the new information to us.

While style and composition are definitely important, our main concern is what the author is saying rather than how he says it. We can correct grammar and smooth out an article, but it is solely the task of the author to convey the meaning and thought that he is trying to get across.

Although there is not a monetary reward for authors who do not win the monthly award, the satisfaction gained by writing for the DIGEST will help you in your future military career. The ability to express yourself clearly and concisely in writing, as well as in speech, is a requisite of any profession. And you will be credited in your 201 file for your article if the DIGEST prints it.

Begin writing your article today. Send your manuscript to the U. S. ARMY AVIATION DIGEST, Ft. Rucker, Ala. 36360. For those who would like to visit or call, the DIGEST office is in building 5703 at Ft. Rucker and the telephone number is (205) 255-3619.

Night LRRP Extraction

A hot LZ surrounded by mountains, jammed guns, bad weather and a patrol pinned down by enemy, turned this mission into a nightmare

Captain Robert C. Lentz

"ROGER, WE'VE marked our position with a grenade. We're in heavy contact."

This confirmed my worst fears. I was a flight leader of a flight of three UH-1 slicks and two AH-1G Cobras. A short time earlier we had inserted a seven man long range reconnaissance patrol (LRRP).

Starting at about 1830 I picked up the LRRP team leader and his CO and went out for a recon of the landing zone (LZ). The gun team was with me.

The proposed landing zone was a one ship LZ in a river valley. From our altitude it looked as though it would be easy to get in and out in a hurry.

The terrain in the area was mountainous with dense foliage but the LZ was a tiny clearing that appeared to be flat. I didn't make a low recon because I didn't want to call any more attention to the area than necessary. The decision was made to insert the team so we returned to the pickup zone (PZ), refueled and loaded the LRRP team.

In executing a team insertion the three slicks go down on the deck in trail formation. The lead slick has the team on board. As the flight approaches the LZ the lead ship drops in and inserts the team. The other two ships pass over the lead ship while the team is getting off. The last ship calls as he is passing over lead. As he passes lead falls in on the trail and the three ships continue on the deck until they are out of the area, sometimes making several fake insertions.

As I approached the LZ I suddenly realized what a bad spot it was. There were high hills on three sides—almost cliffs—and a smaller hill on the approach side. The LZ was just barely big enough for one helicopter and there were tall trees on all sides. Worst of all the LZ was on a steep slope. Unfortunately by the time I had all this information I was on short, short final.

With an approach speed of close to 100 knots, a full fuel load, eight people on board and an LZ like this I suddenly got a big lump in my throat. It was lucky that I was making an insertion instead of an extraction. The slope of the LZ was so bad that I had to hover while the team jumped off. As I was pulling pitch we received three rounds of fire. The LRRP team leader radioed that they were going to try to evade. We orbited the area nervously awaiting word from the team leader who had signals worked out with his commanding officer on board my ship.

From what he was able to tell us the enemy was a well organized unit and was searching for the team.

By this time it was rapidly getting dark and a flare ship was enroute to our location. The team had decided to return to the LZ for extraction. The guns and slicks moved to an orbit point closer to the LZ where we could move in for a quick pickup.

While we were waiting for the final word we made arrangements to have artillery placed on the LZ as soon as we were clear of the area. Finally, word came that the team was ready for extraction. I started my approach with the Cobras covering me. When I called for the team to mark its position I saw a bright flash and heard the feared call that the team was in contact. I quickly broke off my approach so the Cobras could put suppressive fire where the team leader requested it.

The Cobras completed their first run but the team was still receiving fire from all sides. The team leader held up a red flashlight to mark his position

Night LRRP Extraction

The guns held their fire until short final, then opened up simultaneously with Charlie

for the Cobras. By the time the gunships had expended half their loads the team's situation was very critical and our fuel was getting low. To make the situation worse the weather was closing in fast.

I called the troops on the ground and told them to get ready for extraction. The guns picked me up and we started in with flares for illumination but discovered that their reflection off the mist and low clouds blinded the pilots.

On the second approach I lost sight of the LZ and had to make a sharp turn out of the way of the Cobras. All the aircraft were blacked out; then I turned back toward my other slicks. To avoid the Cobras I broke down and away from them which resulted in my real scare—a big, black mountain loomed directly ahead. As we skimmed over the top of it I realized how bad the LZ really was.

I finally got set up for another approach with the guns straddling me. This time the approach would be to a single red flashlight. I left my anticollision light on so the guns could put down effective fire around me. The guns held their fire until short final, then opened up simultaneously with Charlie.

My crew chief and gunner guided me into the PZ while firing their M-60s. This time they had no trouble finding targets.

Since the PZ was on a steep slope we had to remain at a hover while the troops climbed up the skids one at a time. When about three of them had gotten aboard one of the Cobras reported jammed miniguns but continued firing rockets. We were almost loaded when the second Cobra's systems jammed. However the pilot continued to make gun runs on the enemy positions in an attempt to draw fire away from me.

About this time there were several small explosions just at the nose of the ship which momentarily blinded the pilot and myself. In desperation I called for my two chase slicks to come in and make gun runs with their M-60s. As the first ship was coming in the last member of the LRRP team climbed aboard.

We lifted off and started that painfully slow climb. It seemed as though it took forever to get out of range of the enemy fire, especially with no return fire from our ship. One M-60 had jammed with 50 rounds left and the other was expended.

As I topped the mountain I called out my heading to the other ships and started getting some airspeed. At about 1,000 feet absolute and 50 to 60 knots, the engine failed. I bottomed collective and started a

left hand turn while looking for a clearing. The pilot turned on the landing and search lights. I told him to select emergency governor and try a restart. I knew it wouldn't work but it was something to hope for.

I gave my Mayday and learned that the other ships didn't have me in sight. Both the crew chief and gunner called out areas in which they thought we could land. The gunner had the river in sight and the crew chief saw a clearing off to the left. I chose the clearing and lined up on it. On short final to the clearing we discovered it was on the side of a hill too steep for a landing, so I turned toward a large bomb crater on my left and decided to try to land on its edge. I figured that most of the big trees would have been knocked down by the bomb blast.

As I lined up on the crater, I encountered another problem: the lights showed three or four dead trees directly ahead. I had to flare and use some pitch to get over them and when we were almost over the crater I flared hard to try to build rotor rpm. From what I could see it appeared that we were still over trees, so I zeroed out the airspeed and leveled the ship. Just before contact with the trees I made a hard initial pitch pull which didn't even slow us down.

The impact seemed to occur in slow motion. At first there was a terrible crushing feeling as we hit. My chin struck my chest protector and I saw stars. Then still in slow motion I was thrown forward. My head hit the windshield and I was flung back into the seat. I was dazed as my head hit the back of the seat just below my helmet.

I remember sitting there trying to tell myself to get out of the aircraft, but I couldn't move. I thought my back was broken. My right leg was completely numb and I couldn't move my other one although I could feel it. I looked down and saw that my left foot had gone through the bubble and was stuck. I didn't know what to do until I smelled fuel—then I was on my way out of the aircraft!

The pilot's seat had collapsed and he was pinned against the instrument panel, but the gunner was able to free him by tilting the seat back.

It seemed like it took forever for everyone to climb out of the ship and for us to be spotted. But within seconds after we had crashed the other two ships were coming in to pick us up. The flareship dropped flares for illumination and the Cobras were overhead. Our mission had finally ended and everyone had survived a night that they would remember for a long, long time.

Aviation Training Void

A formal course of instruction to prepare aviators for their duties as company and battalion commanders is needed now in order to insure the Army team of the future will have been trained to the fullest possible extent

Lieutenant Colonel Bruce B. Campbell

FIFTEEN YEARS ago there were very few aviation companies in the Army. In fact, there were so few that you could count them on your fingers and still have fingers remaining. The largest aviation command an aviator could expect to receive was an aviation section composed of two to four aircraft and a maximum of 20 personnel. This is not true today. In the Republic of Vietnam (RVN) alone there are in excess of 130 company size aviation units. Additionally, there are approximately 35 aviation battalion headquarters and seven aviation group headquarters. Many of the companies have 31 aircraft and 289 personnel assigned. Some of the companies have a strength of more than 310.

The point is, although the responsibilities of the aviator have increased tremendously over the years, formal training has not kept pace with this increase. Whereas in days gone by an aviator's training in OCS or his branch basic course was adequate for his duties as an aviation section leader, that same training today is completely inadequate for an aviation company commander.

To say that a formal course of instruction should be established to prepare aviators for their duties as company and battalion commanders would not follow a study format, since the subject should be discussed before a conclusion is reached. But, why beat around the bush? A course is needed—*and it is needed now*.

The arguments against advanced aviation training will be long and heated. In all probability they will commence with the statement that such training would lead to an aviation branch. This argument is supposed to stop all discussion of the subject, so let's drop the subject of a separate branch and proceed to the matter of schooling.

Nearly all newly commissioned officers will attend or have attended a basic officers course which give them a knowledge of their basic branch. For the Infantry officer this starts with the squad, works up through the company and touches on battalion and brigade. The same coverage is provided Artillery and Armor officers.

At some point, the officer is programed to attend an advanced course where he learns the essential elements of commanding a battalion and receives additional instruction on brigade or divarty operations. In both of these courses he learns what the commander expects of his staff and this is the important training. The truly outstanding commander must know his staff and what to expect from it.

Where does the Army aviator receive this training? His formal aviation training ceases when he puts on his wings. Oh yes, he may return to an aviation course to become qualified in another aircraft, but is taught nothing about how to utilize a staff or what to expect from it. This knowledge is supposed to come from his career course.

Many contend that all staff elements function basically the same. This is true, but the commander who is willing to permit his staff to function on basic information and basic principles will soon go down in defeat. This has been recognized for years and separate career schools have been established by the different branches to teach something more than basics.

Imagine a young Infantry captain being thrown into an Artillery battalion as the fire direction officer just prior to a combat operation in which success depends on adequate fire support. The commanders participating in this operation would have every reason to be concerned.

Let's take another example. Suppose you are not an aviator. You have been assigned as S-3 of a combat aviation battalion which is stationed in Long Ann Province.

This article reflects the views of the author and does not necessarily represent those of the Department of the Army or the U. S. Army Aviation School

Three days after you arrive, a mission is received from the Airspace Coordinating Element for your battalion to support an operation in War Zone D the following day. The battalion commander is not available to issue his concept of the operation. Could you handle the problem? Basically your actions would be the same as if you were in any other battalion, but what about such specifics as the number of aircraft needed, takeoff time, fuel requirements, PZ and LZ size, allowable cargo load and maintenance support?

There are many other items which you will be expected to know and for the most part you have received as much formal training as the aviation battalion S-3 currently serving in RVN. The difference is that he has gained the rest of the required knowledge through on-the-job-training, which is no way to run a multimillion dollar operation.

The career courses of the Armor, Artillery and Infantry branches go into detail on combined operations utilizing the three branches. The Army aviator who attends these courses learns how to employ armor, infantry and artillery, but his counterparts learn very little about the employment of Army aviation. The subject of airmobile operations is brushed over lightly in spite of the fact that few operations in RVN have been conducted since 1966 without Army aviation support.

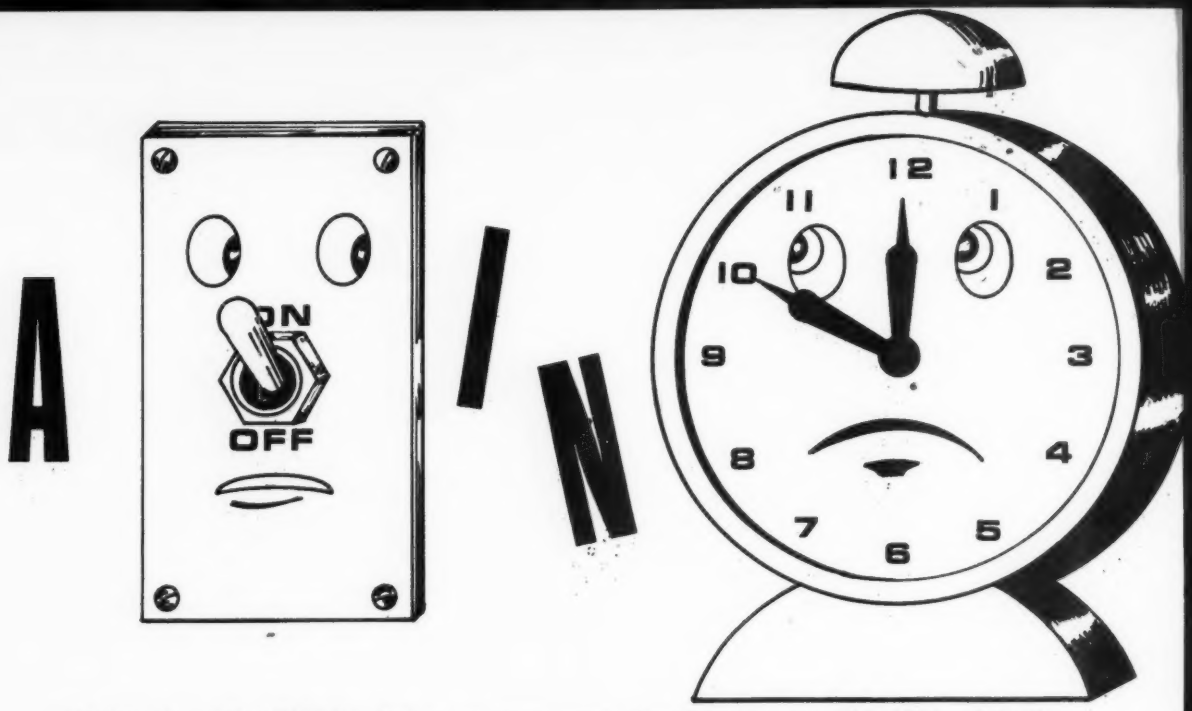
The Army aviator has learned his job in RVN well. But what about after Vietnam? Will he have the opportunity to learn the intricacies of an airmobile operation? Probably not. Company and battalion airmobile operations are expensive in peacetime and will therefore be the exception rather than the rule. Consequently, much of the expertise will be lost within five years after hostilities cease in Vietnam.

Since on-the-job-training only can be accomplished when the job is being done, and because large scale airmobile operations will be few and far between during peacetime, it would appear that a formal school similar to a career course should be established for Army aviators. This school would be on a par with the career courses of the aviator's basic branch. Armor, artillery and infantry subjects should be covered in the same detal as at the current branch career courses, i.e., infantry subjects taught at the artillery and armor schools would also be taught at the aviation career school, etc. By the same token a comparable amount of time would be utilized at the armor, artillery and infantry schools on aviation subjects.

The establishment of this training would insure that all officers of the combat arms will have a working knowledge of each combat arm. Also, it would insure that expertise gained in RVN and future conflicts will not be lost.

Further, an aviation career school would result in additional advantages which may outweigh the direct benefits. Officers assigned as instructors in the aviation career course would be from all combat arms and include aviators and nonaviators. The nonrated officers would learn the capabilities and limitations of aviation and as a result be better equipped to move into combat operations. Aviator instructors would realize that aviation is truly a part of the Army and not just a side line. They would realize that aviation training does equip them for other jobs in the Army and that their allegiance to the Army can be through aviation.

Most important, an aviation career course would insure that the Army team which enters the next conflict will be the best, because it will have been trained to the fullest possible extent. This team will have been trained to work as a team by the best instructors available utilizing the most advanced techniques. Only in this way can we be assured that a team, fielded in 10 to 15 years, can and will function as a team.



Finding the right SWITCH during an emergency situation can save the pilot a lot of TIME and agony. Flipping the wrong switch can compound the emergency and prove to be a fatal mistake. Know your aircraft and be sure to flip A SWITCH IN TIME

CW2 Donald E. Williams

YOU HAVE AN emergency on your hands! The hydraulic servo system has failed in your UH-1D helicopter.

Is this really an emergency? Definitely! Is this emergency uncontrollable? No. The emergency procedure for hydraulic servo failure has been drilled into you so well that you can handle this problem with ease.

In a cool efficient manner you rapidly check to see if the hydraulic circuit breaker is in, because you remember that the switch is a fail-safe system and cannot be turned off unless the circuit breaker is in, and then you pull the breaker out to check for failure of the hydraulic control switch. If a hydraulics failure is confirmed, you check to see if the hydraulic switch is on, in case it had been turned off accidentally, recycle the switch, and if hydraulic power is not restored you turn the hydraulic switch off.

You haven't panicked, but in your haste did you get the right switch? Let us consider the results of repositioning the governor switch from the automatic to the emergency position, or even worse, turning off the main fuel.

You might say to yourself, "Impossible!" But is it really? We shall check the possibilities since the three switches are similar in shape and size and are closely grouped.

First, consider what would happen if you turned off the main fuel switch by accident during a hydraulics failure. Your act has set you up for a hydraulics off autorotation. Are your autorotations perfect enough to try them to the sod (or trees) with the hydraulics off? If you try it, tell me about it later—I would rather learn from your experiences than my own.

If that caused a cold sweat, let's go back to our original hydraulics failure and, in our haste, reposition the governor switch from automatic to emergency. Well, we still have our hydraulics failure and now we may be setting ourselves up for an overspeed on the rotor system with the possibilities of a compressor stall, a complete engine failure and even a slung blade.

Now that we have beat the hydraulics failure idea to death—or was it the other way around?—consider a low-side governor failure. The emergency procedure is to reduce the collective to maintain the rotor rpm in the green arc. Then turn generally into the wind and select a suitable landing area in case it is a complete engine failure. After doing that, you check the gas producer to see if it has stabilized. If it has you have experienced a low-side governor failure.

You immediately reduce the throttle to the flight idle position

and place the governor in the emergency position so that the throttle can be controlled manually. If you missed the governor and switched off the hydraulic servo control switch, you could tell it immediately by the stiffness of the controls. Altitude permitting, you could correct this, but doing so could distract you from adjusting your glide to make the desired touchdown point.

If you had accidentally turned off the main fuel, you would have shut down a perfectly good engine that was trying its best to stay running under a reduced fuel condition. Also, you caused the fuel metering system to be possibly damaged by allowing the fuel to be drawn out of the lines and replaced by air. You wouldn't have a chance of an air restart even if altitude permitted.

How about a high-side governor failure? You shouldn't have any trouble since this doesn't require any switch to be repositioned.

When should the main fuel switch be turned off? During shutdown, engine failures, hot starts and engine fires. If you must turn off the main fuel in flight, the turning off of the hydraulic switch would not necessarily increase your danger, but it might take precious time to correct the mistake. Repositioning the governor from automatic to emergency instead of turning the main fuel off could have more serious results, particularly if you were turning off the fuel because of fire.

The CH-47 also has caused some aviators problems in the position and spacing of switches. The beep buttons for both engines are located beside the search light extend/retract switch on the thrust control. There have been instances at night when attempting to retract or lower the search light the pilot has beeped down one or both engines. Here would be a low rpm condition at night. Usually inadvertent movement of the wrong switch is due to unfamiliarity with the aircraft and/or inattention.

Now that most of the possibilities have been mentioned, solutions must be found to aid in eliminating or reducing such occurrences. Steps have been taken to aid the aviator by the firms that produce the aircraft. In UH-1 aircraft the main fuel and governor switches are being placed on separate rows from each other and are separated from the hydraulic switch by the caution panel.

How can individual aviators reduce the possibilities of these instances? Although one of the best ways is to be completely familiar with the cockpit, this is not always possible. Why? If you are a contact or tactics instructor pilot at the U.S. Army Aviation School, Ft. Rucker, Ala., or a unit instructor pilot (IP), you are constantly flying with personnel who have little or no experience in the aircraft. How familiar are they with the cockpit, especially in an emergency situation? After all, even as an IP you can't do everything yourself. Also, there can be rated aviators in both seats but if one is not current in the aircraft due to illness or for having been flying another type aircraft more recently the results can be the same. As an example of forgetfulness, most rotary wing qualified aviators have spent some time in the OH-23, TH-55 or the OH-13 as a primary trainer. Can you remember where all the switches are located?

The best way to eliminate problems during starting and shutdown is the use of a DA approved checklist. This allows an aviator to be assured of proper starting and shutdown procedures and at the same time familiarize himself with the location of all switches in the aircraft. The abbreviated checklists are unauthorized; only the DA dash 10 checklist should be used.

An aviator should check the dash 10 prior to flight, especially if he is not current in the aircraft or doesn't fly frequently due to other assignments. An emergency is not always a split second life or death decision. By taking your time when haste is not necessary, problems can be avoided by analyzing the emergency and applying proper procedures. After the problem is analyzed all steps should be double-checked as they are performed.

In the case of student training the IP can and should emphasize the importance of switch locations and the student's functions and duties during an actual emergency.

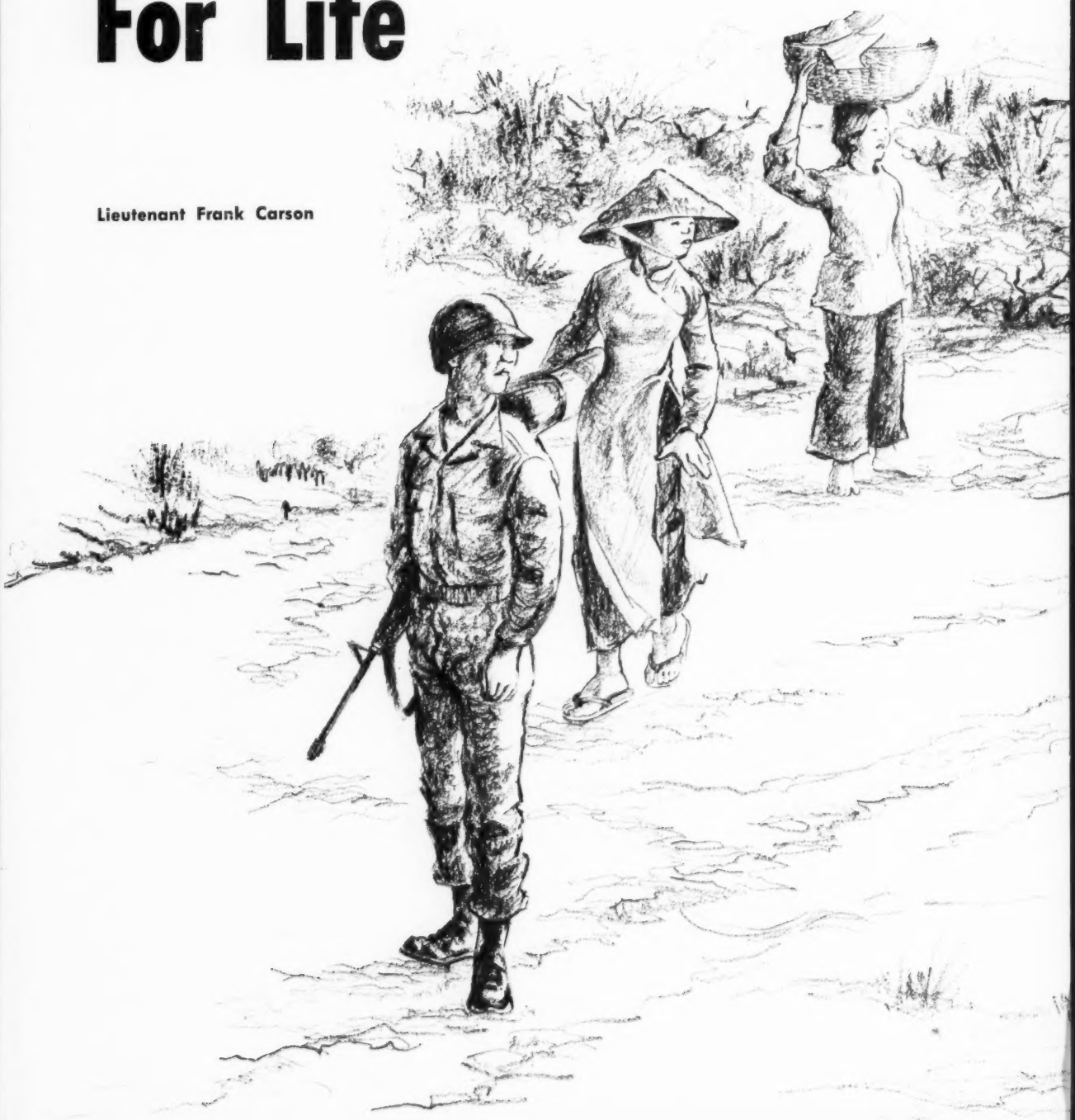
During a panic—especially at night—with all switches the same color the problems still exist. A solution is the use of a different color for each switch and paint that is highly visible at night.

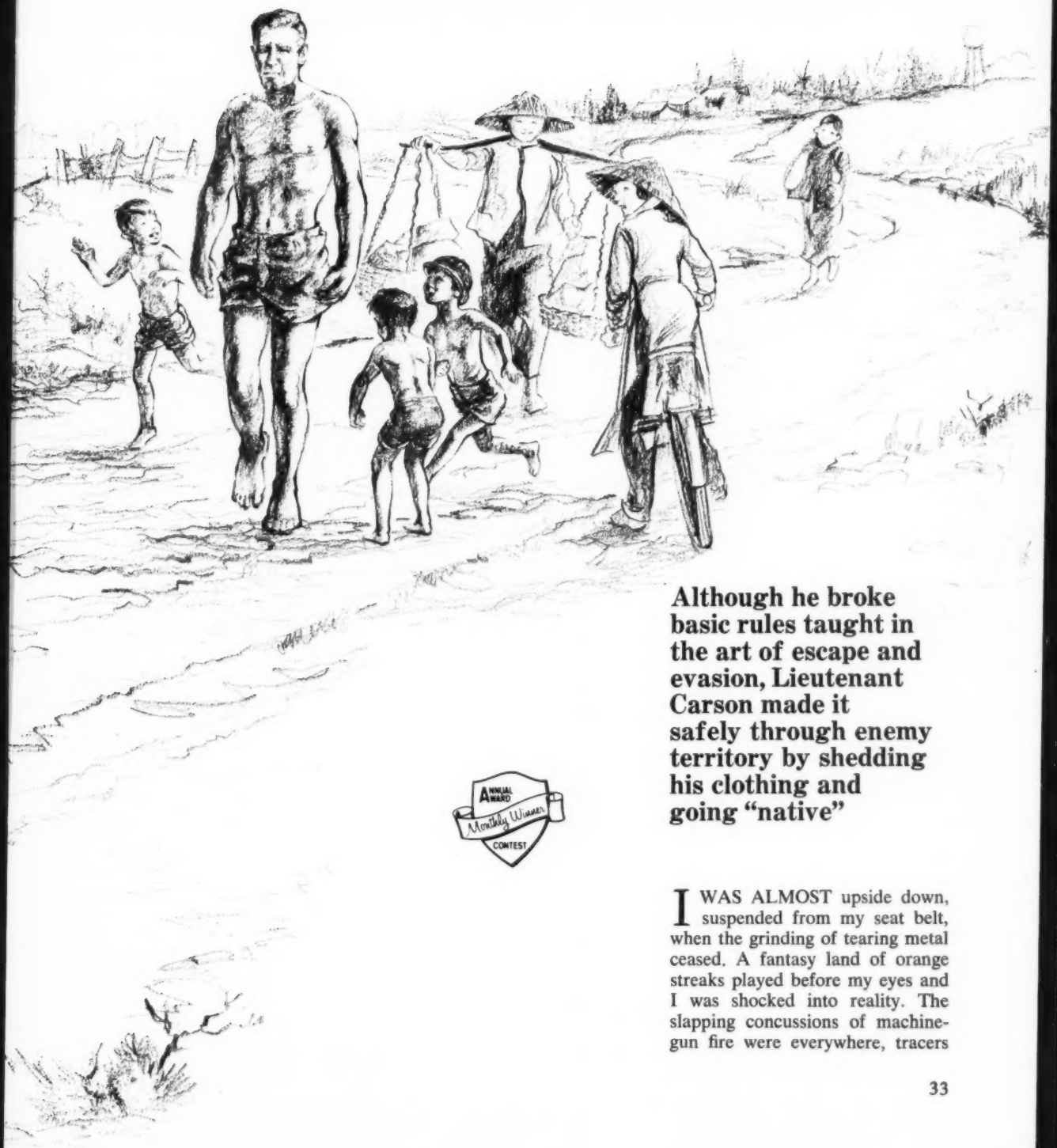
How else can the problem of moving the wrong switch be overcome? Certainly the efforts to design standard cockpit configurations should be continued and given full support by safety personnel. With standardized configurations the transition from one aircraft to another would be easier and less chance for unfamiliarity with the switches would exist. Spacing, shaping and covering critical switches would help reduce inadvertent movements. And, behavioral studies of the aviator in the cockpit environment would bring out weaknesses in design features.

The above ideas are being incorporated in the Army's program to prevent accidents. However, the individual aviator has the first and best opportunity to avoid making mistakes in the cockpit by taking a professional approach. Give yourself a break. Don't set yourself up for an emergency on top of an emergency. Check that switch! Is it the one you really want?

For Life

Lieutenant Frank Carson





Although he broke basic rules taught in the art of escape and evasion, Lieutenant Carson made it safely through enemy territory by shedding his clothing and going "native"

I WAS ALMOST upside down, suspended from my seat belt, when the grinding of tearing metal ceased. A fantasy land of orange streaks played before my eyes and I was shocked into reality. The slapping concussions of machine-gun fire were everywhere, tracers

illuminated the blackness.

Looking back, and to the right, I could see a cargo door . . . then I was on the ground diving for the safety of a rice paddy dike. Like me, the rest of the UH-1C crew found momentary shelter in scattered locations against rice paddy dikes.

A momentary silence afforded time for a self examination. My left arm felt numb and, as I straightened it with my right, the shoulder popped into place. On further examination I determined the cuts on my arms and face to be minor and I had no broken bones to restrict mobility. I was in good shape.

Suddenly the tree line to the immediate front was illuminated in a white blinking rhythm by erupting muzzles; the mud and water around me came alive with snapping bullets.

My rifle, my pistol! They were in the aircraft along with a rescue radio and a survival kit. They all might as well be a million miles away.

Take heed, Army aviators, what the old-timers say is true; if it is not on your person when you crash, then it won't be with you when you exit the aircraft. My pistol belt, I remembered, was hanging on the seat, my survival radio was on the floor.

I was in a completely helpless position with no avenue of escape. It would have ended there for me had not the second gunship commenced pounding the wood line with 17-pound warhead rockets. As the gunship drew the hostile fire to itself, I scrambled to some adjacent brush and for a while observed the heroic rescue efforts being attempted by my gallant companions. However, it soon was obvious that an escape by air was out of the question. The enemy troops were no longer assaulting the aircraft openly because of air cover and flares, but were managing to infiltrate the area. When seven of them glided past my location I resolved to move as far away from the aircraft as possible—otherwise it would only be a matter of time before I would be discovered.

Eventually only the flareship remained overhead. Its murmuring sound with the recurring pop of an igniting flare became a hypnotic rhythm in the still night. One could sense the enemies' silence, listening for a voice, a sound, a movement that would betray their prey.

Then I was aware of the sound of water . . . the gurgle, tinkle of a stream or river. If I could just get to that river—I swim well, and it should flow eastward to the ocean. It could be my avenue of escape.

The flareship was not orbiting directly overhead and, consequently, with each igniting flare the rice paddy dikes were casting shadows. These inky shadows became my camouflage. I eased myself out of the brush and into the black water alongside one rice paddy dike and, remaining in the shadow, I began the painfully slow progress toward the sound of moving water.

As I eased forward on my belly I prayed I would not ripple the water. On reaching each intersecting dike I would wait until the aerial flare died, then slip up and over the top before the next flare ignited. After an interminable time I had covered only several yards, yet the sound of water was louder.

Suddenly a loud whistle and whine broke the night air. It had begun with a high pitch and wound down to a low whine with a resounding thud. The artillery shell impacted and the ground trembled.

There was another more distant impact, and then a closer one; another impacted behind me and another in front. The American artillery, coming from LZ West, was impacting artillery all around our downed ship in the desperate attempt to stay the enemy until morning. How could they know that the enemy was inside the bracket with us? (I learned later that during this time LZ West also was under heavy ground assault, yet continued to provide artillery support for the lost aircraft down in the valley and even tried to locate the ship all night with a huge spotlight.)

I finally reached the river bank and in my ungraceful effort to slide over the top I was spotted (the slime on my fatigue shirt must have shone like a mirror in the flare light, giving my position away). Into the water I splashed with the sounds of shouting and shooting behind me. With the snapping of bullets above, I went under the surface and swam with the current, coming up occasionally only for air.

I began to feel truly trapped again—artillery was pounding on one bank and enemy shouts were getting louder on the other. I chose the artillery side and scrambling onto the bank I began a fast, low crawl. Belly to the ground, my only thought was to keep going. One impact followed another and yet another until my senses became dulled and my ears filled with a dull ringing. (Later a doctor would show me that the concussions had driven tiny pieces of shrapnel and particles of dirt into my chest and side.)

Emerging from my concentration it occurred to me that the concussions were no longer close—the artillery was behind me. I realized that by some miracle or quirk of fate, against fantastic odds, I was now beyond the immediate aircraft area and beyond

the artillery bracket . . . no longer was the wounded aircraft a marker to the enemy for my location. No longer was I a target. The danger of the enemy had diminished.

Dawn could not be long away and I felt mentally and physically exhausted. I decided that traveling during the day would be too risky and looked for a place of concealment in which I could sleep until the next night. The sound of gunfire and impacting shells assumed a distant and far away place, leaving only a ringing in my brain.

Thankfully, I slid down an incline into a sunken area beside a clay embankment. I grabbed an armful of fronds, dead branches and leaves as I went. I let my body sink below the black ooze and with the collected debris I covered my head and chest. Dimly I was aware of movement, but it was not the sound of man. Before my eyes closed I attempted to analyze my future activities toward rescue. I tried to recall the aerial map but could only come up with generalities.

To the southeast an American infantry company was in contact with the enemy. I would avoid this area—the idea of creeping up on a besieged company didn't agree with me at all. To the north was LZ West. It is common knowledge that the slopes of fire support bases are heavily mined—that area was also to be avoided.

I realized that there should be nothing to restrict my movement directly down the valley, due east. Once on the coastal plain I could contact friendly forces more easily . . . EAST! I sat up. Where is east? Above me through a clearing I could see the constellation Cassiopeia, which is north of the zodiac. I drew an arrow facing east in some elevated dirt, then leaned back and closed my eyes. . . .

What caused me to awaken some hours later I do not know; subconsciously, however, I knew something was wrong. The air was heavy with fog, yet the light above me indicated it was morning.

Something was blocking my vision above my eye. I removed the brush from over my head and tried to brush the object from my face but could not. My hand was in view and completely enveloping my fingers and hands were leeches. In a frenzy I pulled at them, but they only slipped through my fingers or broke in half. I finally gathered my composure and, crawling from the water, I sat for a long time just pulling leeches from my body. They had gone up my sleeves, up my fatigue trousers and covered my hands and face, some growing 6 inches and longer.

After I had removed the leeches I stood up . . . but that was the last thing I remember until I awoke from a lying position. Obviously I had fainted.

Suddenly I wanted to laugh; the universe was playing games with me, plucking me from hell only to watch me flounder, too weak to walk. Angrily I rose to my feet. I knew I must move before I weakened further.

As I reflect back I realize I did a crazy thing—I made an insane decision which, comical or not, very possibly saved my life. To travel in my weakened state, I decided I would have to travel an easy path and avoid the rough undergrowth of jungle. To do this I decided to go native-style; off came the clothing, including everything except the dirty, soiled (once white) boxer underwear.

I was dark complected, as are the natives, even though my 6 foot 2 inch frame was stretching the idea a bit. Rubbing a little additional mud around my ankles I brazenly walked out into the morning fog, lacking only my water buffalo. My buried clothes behind me, I went into the middle of the valley striding with toes pointed outward and shoulders sloped as do the natives of the Republic of Vietnam. Thusly I strode, paralleling a major trail which led east, taking care not to go near the main trail nor pass close enough to any object which might afford a perspective on which to compare my height.

Eventually the sun beat through the thinning fog and onto my face. Being successful thus far, my body began to relax as I shuffled along. Then I heard helicopters, followed with the sounds of gunfire. Passing by an embankment I spied beneath an overhang a stack of assorted enemy weapons, and again the adrenalin flowed. I looked neither right nor left and continued my shuffling walk. Eventually I came to the mouth of Que Son Valley long after the sun had devoured the fog, long after my walking became mechanical.

It was afternoon and the sun was on my back when the profusion of natives—men and women on the main trail carrying goods to the marketplace—gave me hope that I was in friendly territory. I apprehensively turned to intersect the main trail.

Immediately several nearby and very surprised natives looked at my height, then my face in astonishment. Shortly I had collected no less than 20 children, laughing and shuffling along with me.

A Popular Forces (South Vietnamese) soldier who witnessed the comedy approached and attempted to communicate a question. Over and over I talked on an imaginary phone until he finally got the idea and led me (followed by an impossible assortment of natives) to the outpost of Nuic Loc Son. Here a bewildered American sergeant radioed for a medevac helicopter and within the hour I was in the American infirmary on Hill 35. Now I could relax, contemplate my ordeal and thank my friends —*for life.*

THE RECORD:

Army aircraft were involved in eight midair collisions during 1967 and eight more during 1968. Through 15 November 1969, midair collisions have more than doubled over the two previous years with 11 occurring in one 4-month period.

MIDAIR COLLISIONS, crowded skies and the gadgetry and techniques for collision avoidance have been spotlighted by national news media in recent months. And rightly so. Our skies *are* more crowded and aircraft *are* growing in number, complexity and speed. New equipment and techniques *are* needed. However, until they are available, we must not forget the lessons of the past. As one wise airman said, "Those who cannot remember the past are condemned to repeat it."

To refresh your memory, here are some of the lessons of the past—

A survey of 452 near misses several years ago revealed that most occurred in controlled airspace under VFR conditions in daylight, under 200 mph in level flight. If these pilots were looking for other aircraft, why didn't they see them in time to avoid near misses? These were some of the reasons:

LEARN TO LOOK! LOOK TO SEE!

- Blind areas caused by aircraft structures.
- Other aircraft between pilots and sun.
- Dirty windows and windshields.
- Window shades or glare shields left in place in dangerous (high density) areas.
- Training aircraft with hoods or shields blocking observers' views.
- Failure to look for other aircraft.

A study of 102 midair collisions involving civil aircraft during a 7-year period revealed that 91 percent occurred in clear weather. During one of these years there were 14 midair collisions involving civil aircraft other than air carriers. All occurred within a 5-mile radius of an airport. Eight were in an airport traffic pattern, with four happening on final approach, three during takeoff and one on the downwind leg. All 14 occurred in clear weather during daylight hours. Analysis of these accidents revealed that the primary causes were probably cockpit visibility, relative speeds, aircraft conspicuity and the physical condition of the pilots.

Recognizing the cockpit visibility problem, the CAA Technical Development and Evaluation Center at Indianapolis made an investigation in 1948. A survey of 6,000 airline pilots was made and the results indicated that aircraft of that era, as a whole, were completely inadequate from the standpoint of cockpit visibility.

Pilots surveyed indicated that they considered the area from 0 to 30 degrees to each side of the center of the pilot's seat to be the most important to visibility, with the sector from 30 to 60 degrees next in importance. They also indicated that, because of the importance of these areas, they should be free of posts or other obstructions. Minimum downward visibility indicated by the survey should be at least 8

CRASH SENSE

the following 28 pages prepared by the U.S. Army Board for Aviation Accident Research

Four of the most recent collisions involved helicopters flying in formation. If you observe this simple tenet, you can prevent all helicopter formation collisions: "Maintain at least two rotor diameters between aircraft!" Formations closer than two diameters serve no useful purpose!

degrees below the horizon during a straight climb and at least up to the horizon, plus 13 degrees in a glide. The pilots expressed little interest in having rearward visibility beyond 0 to 135 degrees on each side.

After investigating several methods in 1950, the CAA developed a standard means for measuring cockpit visibility. A camera with two lenses was set up to make a 360-degree sweep of the cockpit at the pilot's eye level and the lenses were gridded and synchronized so that photographs were divided into grids representing the number of degrees around the cockpit azimuth. This grid pattern produced a workable graph through which information concerning visibility could be analyzed. Using this method, mirrors and cameras were mounted in the cockpit of a transport airplane and photographs were made of the eye movements of 11 pilots. Researchers were then able to read 35,817 of these photographs and interpret them on the basis of the 360-degree graph.

This study revealed a definite need for increased cockpit visibility. It also revealed pilot faults in the use of the windshield areas available. The areas of the windshield most often used were those required to obtain visual cues necessary to operate the airplane rather than those enabling pilots to search the air for other aircraft. While midair collisions obviously cannot be avoided by the use of windshield areas alone, since extreme visual angles may be required during many collision conditions, it was concluded that certain minimum angles in cockpit design will tend to decrease the probability of midair collisions.

Another CAA study released in 1955 produced two important conclusions regarding relative speed as a midair collision factor:

1. No apparent motion from the pilot's viewpoint exists between two aircraft which are flying straight and level on collision courses at constant speeds.

2. The most severe midair collision hazard from a visual-angle standpoint exists between aircraft that are flying at small differences of heading and speed. During this condition, even when the closing rates are small and much time is available for evasive maneuvers, the visual-angle restrictions of present-day aircraft do not permit the pilots to observe each other.

Several of the 1954 collisions studied were accidents in which one airplane crashed into the tail of a similar, but slightly slower airplane. Investigation revealed that the pilots of the overtaking airplanes had the others in full view. But, because of the failure of their eyes to detect the differences in relative motions between their airplanes and the ones they were overtaking, the collisions occurred.

Another common denominator of many midair collisions and near misses is nonalertness. The only difference between a collision and a near miss in many instances is that at least one pilot was alert enough to see and act in time to avoid collision. But this only answers the question of *what* causes many collisions and near misses. This information is of little value unless we know the answers to *why*. To understand and correct the problems, we have to look at them through people—*through human traits and failures.*

One answer to *why* is that aviators don't know how to look. While this applies more to inexperienced pilots, it is by no means confined to this group. One of two aviators aboard a U-8 that collided al-

most head-on with a light airplane had more than 6,000 flying hours. The other had more than 3,000.

Fledgling aviators are taught the mechanics of looking around from their first day in the air. They look because their instructors tell them to look, but they see very little. Gradually, as they build experience, they begin to see and recognize other aircraft. They form and store mental images of other types and sizes of aircraft as they appear from various distances, from below or above, closing or going further away. Hopefully, they learn what to look for and how to see from the air. But the difference between looking and seeing is a wide gap to bridge.

If you are reading this with concentration, you are at this precise moment unaware of what is taking place around you. In your conscious effort to absorb and understand these words, you have excluded all else—unless you're one of those rare geniuses with a simultaneous multichannel brain. Most of us come equipped with single-channel transmitters and receivers. We have to consciously tune in what we're receiving, either orally or visually, for it to be transmitted to our brains for action. Our brains also contain built-in censors. If we can't believe what we see, our eyes may focus on it, but we won't consciously see what we're looking at if it fails to pass this censorship.

Human visual perception has been compared to reading a large newspaper by the narrow beam from a pencil flashlight. Though our eyes are capable of taking in the whole newspaper, our minds limit what we can see and comprehend. Our area of conscious attention is not nearly so large as the area our eyes can see. But the smaller area of conscious attention determines what we can see with perception and understanding. A pilot *must* be able to divide his attention between flying the aircraft, planning ahead and remaining alert for other aircraft. He must make his single-channel receiver juggle these three items every second he is in the air. The faster the aircraft, the more crowded the sky, the faster this mental juggling must be.

Another answer to *why* is fatigue. The suggested maximum flight hours in Section III, AR 95-1, are not just arbitrary figures. They were developed through long experience as the maximums which can safely be flown by average pilots under normal conditions. One pilot involved in a midair collision had exceeded the suggested monthly maximum by more than 35 hours. Tired or exhausted pilots cannot be expected to maintain the degree of alertness necessary to avoid near misses and collisions.

Still another answer to *why* is drugs. A pilot involved in a midair collision of two Army aircraft had a cold and was taking a patent medicine. He had not reported his illness or the medicine he was taking to the flight surgeon. The patent cold remedy he was taking contained a sedative. This ingredient causes drowsiness and a slowdown of perception and reaction time. He definitely should not have been flying while taking the drug.

Two UH-1Hs flying right echelon formation collided, killing eight crew members and 18 passengers. Both helicopters burned.

Questions asked witness: "Before they collided, were they flying close together?"

"Yes. They were very close. They started flying very close soon after they left the ground."

"Did one of the helicopters seem to make a sudden or fast movement just before they hit?"

"No. The one in back flew into the one in front slowly. They did not hit each other. Only the rotor blades touched and then they fell."

"Could you tell how high they were when they hit?"

"Yes, about 1,000 to 1,500 feet."

Investigation narrative: ". . . Number 2 aircraft flew too close to the lead helicopter, causing the rotor blades to strike each other. The two helicopters were seen flying in tight formation earlier in the day and were seen by witnesses joining up in formation so that they were very close together on the last flight. . . .

"The aircraft commander of the number 2 helicopter used poor judgment in flying unnecessarily tight formation on his lead ship and the flight commander used poor judgment in permitting the tight formation. If the separation had been greater, the collision probably would not have occurred. The most likely reasons for the collision were diverted attention and insufficient separation to allow time for recovery. . . ."

Beverly Howard, internationally famous aerobatic pilot and president of Hawthorne Aviation, has spoken to many graduating classes of military pilots. He always ends his talks with these words: "Remember, you fly with your head, not your hands and feet." Mr. Howard's advice is sound. To it can be added: You look with your eyes, but you see with your head. Are YOU looking and *seeing*?

AN OH-6A, WITH a pilot and three passengers aboard, departed a base camp at 1745 to perform an engineer reconnaissance of bridges on a highway. While making a reconnaissance of a bridge, the helicopter struck the water and sank at approximately 1817. The pilot had initiated flight following upon takeoff and a position report was due at 1815. The flight following service started a radio search at approximately 1830 and by 1900 it was determined that the helicopter was lost in the river.

Two passenger survivors were recovered immediately after the crash. Search operations for the helicopter and other possible survivors continued until 0200 the following morning, when operations were suspended until daylight. After daybreak, search operations were resumed and the helicopter was found in 30 feet of water. All components were recovered except the tail cone center section, three main rotor blades and the log book.

Investigation: ". . . Early positive identification of the aircraft was accomplished by the recovery of an inspection panel marked with the aircraft serial number which was found floating on the river. . . . The wreckage was dragged to shallow water, then recovered by a UH-1 helicopter.

"The board used witnesses to determine the actual flight path, altitude and attitude of the OH-6A prior to and at the time of the accident. It was determined that the reconnaissance was being performed at approximately 75 to 100 feet, at 50 to 60 knots airspeed. The aircraft was in a right bank of 40 to 60 degrees at the time of impact. It passed over the bridge at approximately 75 feet, made a slow descending right turn and hit the river.

"Information obtained from witnesses indicated that something yellow, about the size of an individual C ration box, was dropped from the aircraft into a boat. Neither surviving passenger had any knowledge of anything being thrown or dropped from the aircraft.

BLOCKED COLLECTIVE

The aircraft accident investigation board used models and drawing to recreate flight path. This photo, last in a series of nine, shows OH-6A as it hit water. Note boats to right of helicopter and bridge at top left of photo

"The survivors stated there were no unusual attitudes, movements, noises or other unusual indications of aircraft malfunction, except for a sudden gust of wind immediately prior to impact. Both stated that a sharp gust of wind came in the right passenger door, dislodging a clipboard and papers from a passenger's lap. The survivors stated that no abrupt control movements were noticed and the aircraft seemed to fly into the water in a slightly nose low right bank. Both stated the engine was running and everything functioning normally. Witnesses located on the bridge stated very definitely that the main rotor blades made first contact with the water."

Photo of OH-6A after recovery and before it was cleaned

Analysis: "When the aircraft was returned to base, it was inspected, photographed and moved to a maintenance hangar for technical analysis. Heavy deposits of mud and silt were removed from the interior and members of the board reconstructed the aircraft debris and components as much as possible.

"From thorough technical analysis, no mechanical malfunctions could be determined. The engine, main transmission and tail rotor transmission were removed, inspected and found to be operative. These components were forwarded to a laboratory for a further analysis. Analysis of the flight control systems revealed no malfunctions or missing components.

"Further examination of the collective system revealed:

"1. Both pilot and copilot collectives were in the full up position.

"2. The pilot's collective stick tube was broken.

"3. The area surrounding the copilot's collective was totally free of impact damage.

"4. The left side copilot's safety belt was found wedged between the collective and the left side panel of armor plating.

"5. The collective stick cover located above the base of the copilot's collective was found bent and ripped from its screwed position upward, striking the armor seat plating.

"6. The main rotor hub assembly and remaining pitch hub was in the full pitch position, although all pitch change links were snapped.

"7. Damage to the collective push-pull tube assembly was determined to be from impact.

"8. The rigid connecting link (item 14, figure 119, TM 55-1520-214-35P, FSN 1680-761-1729) was not damaged in any way.

"Examination of the seat retention system revealed:

Seat belts, designed to save lives and prevent injuries, are the same as other loose objects when it comes to flight hazards. Read this account of a fatal helicopter accident which may well have resulted from a loose seat belt

Photo shows broken pilot's collective tube

BLOCKED COLLECTIVE

"1. The passengers' retention straps were used and did not fail.

"2. The pilot's seat belt and shoulder harness were used and did not fail.

"3. The copilot's seat retention system presented an element of doubt about whether it was properly fastened. The left strap of the left belt was wedged between the collective stick and the left side armor plate. Both retention strap locking devices were in the unlocked position. The pilot's inertia reel had been activated to the automatic inertia locked position. The copilot's inertia reel had not been activated

Photo shows copilot's seat belt wedged between collective and armor plate as it was found by investigation board

and a test revealed that this unit was still operational.

"Analyzing all available facts, the board developed the following hypotheses: At some time, the lap belt of the passenger in the copilot's seat became wedged between the copilot's collective and the left side of the seat armor. It could not be determined whether the passenger's seat belt was not fastened or whether it was first fastened and later unfastened for some unknown reason. Witnesses stated that the pilot had made a visual check of the back seats to see if the belts were secured. On initial examination of the aircraft, the copilot's seat belt was found wedged between the collective and armor plate. Marks on the armor plate and collective stick indicated that some force was applied to some object in this location.

"The board compared different aircraft and found that when the collective is in low pitch and the seat belt is released and allowed to fall free, the belt adjusting buckle falls naturally into position between the collective and the left side armor plate. If the aircraft was in a descending right turn with the seat belt adjusting buckle wedged in this position, insufficient upward collective travel would have been available to arrest the descent. It is the opinion of the board that this situation caused the accident. If this demand was being made upon the pilot's collective when the aircraft hit the water, the shock could have jarred loose the object binding the collective. This would allow the pilot to apply full force upward on the collective system and lock it in place during impact.

"Additional evidence in support of this theory is available. The copilot's seat inertia reel did not lock upon impact, as did the pilot's, although the inertia reel locking handles were in the identical unlocked position. There was a dent in the plastic console sun shield which may have been made by the passenger sitting in the copilot's seat impacting the shield. The copilot's antitorque pedal assembly was broken from the aircraft and lost. The front bubble on the copilot's side was smashed and the instrument console was broken from its mounting on the left side. The pilot's collective stick was broken in an upward direction as indicated by the break and there was no damage to the U bracket which supports it from beneath. A sharp downward force would probably have deformed this bracket. An autopsy of the passenger who was sitting in the copilot's seat revealed a cut behind the left ear which could have been made by plexiglass.

"It was possible that much of this damage was made by dragging operations. The board considered this possibility and concluded that although this was possible, no marks, scratches or holes from the dragging apparatus were present. The collective push-pull rods showed secondary damage, but they were still intact and operational after they were straightened. The throttle linkage was not damaged except for the pilot's broken collective. The remainder of the system was intact and in the normal operating range."

Findings: "Established: Unknown.

"Suspected: 1. Copilot's left lap belt buckle wedged between the collective and the left side seat armor.

"2. Unknown object wedged between collective and the left side seat armor.

"3. Abrupt turn to the right produced vertical lift on the horizontal stabilizer surface, causing the aircraft to pitch nose down and aggravate bank angle to right.

"4. Pilot failed to require passenger to keep seat belt fastened during flight."

Recommendations: "1. Fabricate a copilot's collective shield for the OH-6A.

"2. Correct TM 55-1520-214-10 to include a CAUTION or WARNING block above paragraph 8-5b.

"3. Institute a repetitive training program to remind pilots of all units of the dangers of low altitude flying over water.

"4. Survey pilots and indicate on DA Form 759 whether swimmer or nonswimmer for consideration before assignment on extended overwater missions."

Flight surgeon: "It is difficult to completely ascertain injury factors in this accident. . . . We know that all three passengers and pilot survived the immediate crash and were able to escape and surface. The pilot

and the passenger who had been seated in the copilot's seat then disappeared under the water. In the passenger's case, it is suspected that he was not wearing his lap belt or shoulder harness. There is no autopsy evidence to confirm or refute this. . . . His one laceration could have been produced during the crash, especially if he were not wearing a seat belt, but it is more likely that this was acquired during escape from the aircraft. We have no autopsy evidence that his head injury was significant. He may, however, have been stunned by a blow on the head, been able to escape and surface and remove his sidearm and other equipment and then become unconscious or so weakened he was unable to move and was therefore carried under and downstream to drown.

"In the pilot's case, it may be assumed that he survived the crash intact, but dazed, and was so weakened in the attempt to remove his heavy equipment and fight the current that he drowned.

"There was no water crash survival equipment available in the aircraft.

". . . Low altitude flying over water has inherent risks. Possibly for all missions in which an amount of flying over water is involved, the wearing of appropriate survival equipment such as water wings should be a prerequisite. These two lives *may* have been saved with such equipment. . . ."

Reviewing official: "Suspected cause factors are amended to read:

"a. Operation: During an abrupt reversal turn to the right at low altitude, an object wedged between the copilot's collective pitch and collective pitch cover. The momentary binding distracted the pilot and resulted in his flying the aircraft into the water.

"b. Operation: Pilot permitted passenger to release seat belt in flight for reasons unknown. During an abrupt reversal turn to the right at low altitude, the seat belt buckle lodged between the collective pitch and seat armor. The momentary binding distracted the pilot and resulted in his flying the aircraft into the water.

"c. Design inadequacy: The opening between the copilot's collective pitch and collective pitch cover permits insertion of an object which would limit collective pitch travel sufficiently to distract the pilot during a critical maneuver.

"The pilot erred in operating the aircraft over water at an altitude and airspeed which would not permit a forced landing on land. No life vests were available to the occupants (paragraph 4-13, AR 95-1). However, had this aircraft impacted on land in the same manner in which it impacted the water, it is doubtful anyone would have survived.

"Aviation section/unit commanders were directed to discuss this accident at the next regularly scheduled safety meeting and the following letter was dispatched to all aviators in this command:

"Subject: Aircraft Accident Prevention

"1. A recent OH-6A accident resulted in two fatalities and destruction of an Army aircraft. As are all accidents, this one was avoidable. While the true cause factors may never be known, the accident board established pertinent recommendations which are plausible and therefore pertinent in our efforts to prevent a similar accident.

"2. Actions to be taken by aviators to preclude a similar accident:

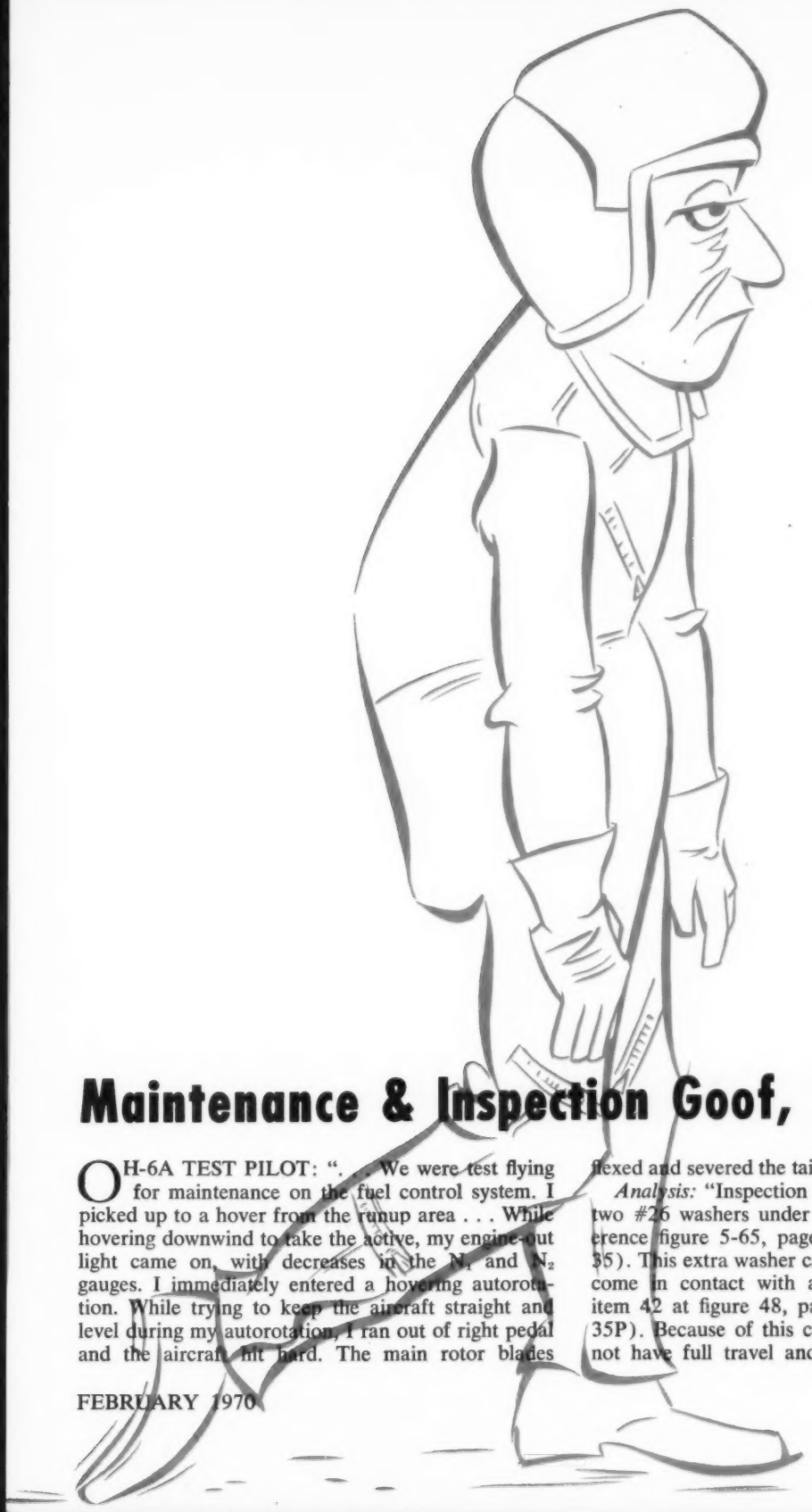
"a. The cockpit passenger will have the shoulder and lap harness fastened, at all times, from liftoff to touchdown.

"b. Insure the area adjacent to either collective pitch stick is clear of any objects which might restrict movement of the collective.

"c. All OH-6A aviators refamiliarize themselves with the following information extracted from TM 55-1520-214-10, dated December 1967. Paragraph 8-5b reads: Abrupt turn maneuvers. Abrupt turns to the right are more critical than those to the left. If an abrupt reversal turn is performed at low altitude and low airspeed, caution shall be exercised to prevent yawing the tail excessively into the wind during a 180-degree turn downwind or downwind approach to hover. Such a maneuver can produce lift on the horizontal stabilizer surface, which may require full aft cyclic to counteract. If excessive nosedown pitching is encountered, apply antitorque pedal to bring nose into the wind. Additional collective aggravates pitching and is not recommended.

"3. Unit/section SOPs will reflect the following: Flying over water. Every aircraft making extended or sustained flight over bodies of water where forced landings on land cannot be negotiated will be equipped with sufficient life vests for the number of persons aboard. Aircraft not so equipped will fly at an altitude and airspeed which will permit a forced landing on land."

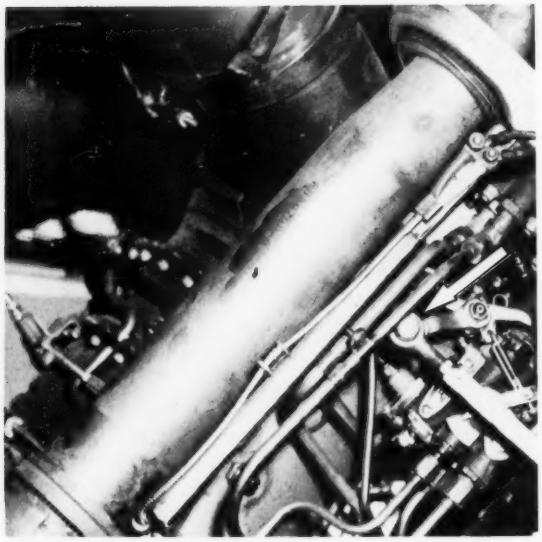
Approval authority: "The findings and recommendations of the accident investigation board, as amended by the reviewing authority, are approved. DA Form 2028 will be prepared, recommending paragraph 8-5b of the dash 10 be listed under a WARNING."



Maintenance & Inspection Goof, Tired Pilot

OH-6A TEST PILOT: ". . . We were test flying for maintenance on the fuel control system. I picked up to a hover from the runup area . . . While hovering downwind to take the active, my engine-out light came on, with decreases in the N_1 and N_2 gauges. I immediately entered a hovering autorotation. While trying to keep the aircraft straight and level during my autorotation, I ran out of right pedal and the aircraft hit hard. The main rotor blades flexed and severed the tail boom."

Analysis: "Inspection of the engine area revealed two #26 washers under the head of #28 bolt (reference figure 5-65, page 5-100, TM 55-1520-214-35). This extra washer caused the head of the bolt to come in contact with a tube assembly (reference item 42 at figure 48, page 131, TM 55-1520-214-35P). Because of this contact, the control tube did not have full travel and the engine was unable to



Extra washer under bolt head caused bolt to contact tube and control tube did not have full travel, preventing engine from developing power demanded by pilot hovering downwind

develop the power demanded by the pilot while hovering downwind.

"It is apparent that the loss of power was due to the #28 bolt head coming in contact with the tube assembly. The question that is raised is why the actuating tube assembly was not checked for full travel during preflight. After talking with the technical inspector and pilot, several inspection discrepancies were noted. The technical inspector inspected for the obvious and found the bolt in the right way, with cotter pin in properly. He *partially* inspected the travel of the tube assembly. His inspection of this part included 30% travel and full off, *but not full power*. During his preflight, the test pilot also inspected for the obvious. He checked to insure the bolt was secure, but did not check the travel of the tube.

"The fact that the pilot was hovering downwind was a contributing cause factor. Hovering downwind required the pilot to apply aft cyclic to maintain a slow hover and resulted in a nose high attitude. Because of the nose high attitude and low rotor rpm, the pilot was unable to level the skids and maintain heading during the autorotation. Also suspect the pilot failed to recognize the initial rotor rpm loss and was late in applying corrective action.

"The pilot was in a state of chronic fatigue and this may be the reason he failed to perform a proper preflight and recognize initial loss of rotor rpm. Supervisory error is obvious in that this aviator had been given the day off due to high flying time and was then scheduled to perform a test flight."

Flight surgeon: "The pilot had served as an OH-6A scout pilot for several months. This mission makes extreme demands upon a pilot and he had frequently flown 9 to 11 hours per day on this mission. He had not had a day down for many days prior to this mishap and had flown 151 hours in the preceding 30 days. Prior to this accident, he was enjoying his first afternoon off in many days when he was awakened to test fly this aircraft. His irritation may have been a contributing factor in the faulty preflight.

"Additionally, I had known that the pilot was suffering from mild chronic fatigue during this period. He would have preferred to be grounded at 140 hours, but was unable to do so without seriously jeopardizing his fellow OH-6A aviators who were also fatigued and had over 140 hours."

The following letter was dispatched to units in the command:

"Subject: Aircraft Accidents, Maintenance Errors

"1. The investigation of a recent aircraft accident established the cause factors as maintenance and inspection errors. For the sake of a 10-cent washer which was installed in error, followed by an inadequate technical inspection of the work performed and an inadequate preflight by the test pilot, $23,000 in damages resulted.

"2. Effective immediately, addressees will review unit or section maintenance practices and SOPs and insure that:

"a. Technical inspections are conducted in accordance with appropriate technical references and that inspectors do not resolve technical inspection requirements by recourse to memory.

"b. Maintenance is performed in accordance with appropriate technical references which are to be immediately available to the mechanic at the work site.

"c. Test flights will be accomplished by the best qualified pilots, possessing the most aircraft maintenance experience, with assistance as necessary of the most proficient crew available."

LACK OF LUBRICATION AT WHAT ECHELON?

A UH-1D, WITH AN AC, pilot and four passengers aboard was on a flight to drop off the AC and three of the passengers at an airfield to pick up another aircraft. After the dropoff, the pilot and one passenger were to continue to another airfield to have the No. 1 hanger bearing bracket dye checked.

A gradual descent was started to be at approximately 400 feet when they reached the first airfield. At 1,200 feet and 80 knots, a high frequency vibration developed in the pedals. The AC increased the rate of descent and selected a forced landing area. He thought the high frequency vibration and whining noise were coming from the main transmission. He did not autorotate for fear the main transmission would seize when the power was reduced. The descent continued and the helicopter yawed 45 degrees to the right. Left pedal was applied but the right turn continued. The aircraft was banked to the right to compensate for the yaw and a Mayday call was made.

They went into a fast spin at approximately 200

Male spherical coupling had all splines severed. Note intensive heat discoloration (arrow)

Heater compartment of crashed UH-1D. Note close proximity of parts carried in compartment to tail rotor servo (arrows)

Female drive shaft coupling showed absence of lubrication and damaged splines within coupling

feet and the AC rolled off throttle and pulled in all remaining collective. The left skid struck the ground and the UH-1 bounced into the air and came to rest on its left side. The AC and three passengers sustained back sprains and facial lacerations and the pilot and other passenger had facial lacerations.

Flight surgeon: "The aircraft hit with moderate decelerative forces. . . . There were no fatalities and only minor injuries incurred. . . . Apparently in order to make more room for supplies, all seats with the exception of the crew members' seats, were up. Two passengers were seated on crates of supplies and were not wearing any kind of restraint. The other two passengers were in seats, but did not have their seat belts fastened. Passengers should be in seats at all times and all personnel in an aircraft should wear seat belts."

Analysis: ". . . The vibration most likely originated between the tail rotor quill male spherical coupling and drive shaft coupling. The high frequency vibration, existing for 30 seconds, seems to indicate that

Rigid by-the-book maintenance, inspection and operating procedures are the only acceptable methods of preventing maintenance-caused accidents

failure of the splines was not instantaneous, but more of a rapid deterioration of the splines in both the drive shaft coupling and male spherical coupling. The high frequency vibration from this type of failure would be transmitted through the drive shafting rack to the tail rotor 90-degree gearbox and then return through the cables to the push rods and tail rotor pedals. The vibration from this type of failure would normally be felt in the cabin area . . . and would be severe enough to transmit the vibration from the transmission through the transmission mounts into the airframe.

"After the 30 seconds of high frequency vibrations, the aircraft yawed 45 degrees to the right and would not respond to application of left pedal, nor streamline, although airspeed was 80 knots. When the yaw occurred, it was an indication of total failure of the splines driving the male spherical coupling and the drive shaft coupling. The male spherical coupling continued to turn, generating a great amount of heat which caused heat discoloration of the coupling. . . .

"A complete investigation was made into the cause of the failure of the tail rotor quill. It was concluded that the primary cause of the accident was lack of lubrication of the tail rotor drive shaft coupling and male spherical coupling. A review of TM 55-1520-210-20 revealed that the lubrication of the tail rotor quill assembly is due every 500 flying hours. Aircraft hours at the time of the accident were 2562:30 airframe hours. The next PE was due at 2569:35 hours. The aircraft was still 07:05 hours out of the fourth periodic inspection. Lubrication of the tail rotor quill was not due until the fifth periodic inspection. The aircraft was still 107:05 hours out of the fifth periodic inspection. Aircraft records indicated that an IRON was conducted 8 months before the accident. Aircraft time at IRON was 2158:15 hours. The tail rotor quill coupling should have been lubricated in accordance with TM 55-1520-210-20 at that time. All DA Forms 2408-13 and DA Forms 2404 were checked from 4 months before the accident to the date of the accident. This inspection revealed that neither the tail rotor quill nor the tail rotor drive shaft couplings were removed while the aircraft was assigned to this unit. . . .

"The aircraft was flown on a circle red X status. Although it was an incorrect designation, the pilot still erred in that he took passengers and planned for more than a one-time only flight. He was not aware there was an incorrect status designation."

Findings: "Established: Maintenance cause factor in that the tail rotor quill was not lubricated.

"Nonrelated: Supervisory factor in that the AC did not insure that all personnel were properly seated and restraining devices used.

"Nonrelated: Supervisory factor on the part of the AC. Aircraft parts were not secured in the heater compartment of the aircraft and could have easily affected the functioning of the tail rotor servo.

"Nonrelated: Supervisory in that an aircraft with a circled red X condition was used to carry passengers."

Recommendations: "More emphasis on quality control at all echelons of maintenance.

"Command emphasis on the use of restraining devices.

"A regulation prohibiting use of heater compartments of UH-1 aircraft for carrying cargo or baggage.

"That all pilots, especially maintenance pilots, be told about the status symbols for aircraft and flight limitations for each symbol."

Appointing authority: "Concur with the findings and recommendations. The following actions have been taken to prevent recurrence of this type accident:

"A letter has been written to each company commander reemphasizing that no baggage or cargo of any kind will be carried in the heater compartment of a UH-1.

"The maintenance officer is conducting classes on aircraft status symbols and their flight limitations.

"Aircraft commanders and pilots have been given classes on their responsibilities for insuring that all passengers in their aircraft have proper seats and restraining equipment, except when tactical situations dictate otherwise."

Indorsement: ". . . The primary cause of the accident was failure of the tail rotor quill. A contributing cause was maintenance error in that the tail rotor quill was not lubricated in accordance with TM 55-1520-210-20. An additional contributing cause factor was pilot error in that an improper emergency procedure was used with this type of tail rotor failure, as outlined in the dash 10. Recommend that emergency procedures for all types of tail rotor failure be emphasized by unit SIPs and IPs on a continuing basis."

Approval authority: "The findings and recommendations, as amended by the indorsement, are approved."

CH-47A AC: "We landed, refueled and shut down because the load we had to take was to be loaded internally. It consisted of two pallets which weighed 1,800 pounds each, one pallet which weighed 1,400 pounds and five baskets weighing about 80 pounds each. We figured the total load at 6,000 pounds and, since our maximum gross was 8,000 pounds, we would have no problem.

"The officer in charge of the cargo told me he had passengers that had to go with the load. I asked how many and he told me 50. Since I had an A model, I told him I couldn't carry that many people. . . . He said that he at least wanted me to try and I explained that I would never get the load off. He said the passengers would not understand unless we at least tried. . . . I agreed to try. I had a discussion with my crew and explained to them the reason for all the passengers.

"The passengers were loaded aboard and we started the aircraft. The pilot called the tower and told them we would be making a hover check. I attempted to pick the aircraft up to a hover and found that I could not maintain rpm and was way over gross, so I put it down. I told the crew chief to put half the people off and about 2 dozen were taken off. I came up to a hover again and with 830 pounds of torque at max beep, the rpm dropped to 228. I put the aircraft down again and told the crew chief that I couldn't take but about 15 passengers at the most. He offloaded more passengers, about 15.

"We called the tower and asked for a hover check again. The tower approved and I picked the aircraft up to a good 15-foot hover and saw we were pulling 770-780 pounds torque at 230 rpm and the N_1 gas producer showed about 91 or 92 percent on both engines. I was cleared for departure after reporting the hover check complete and, without adding thrust, I began a normal takeoff to the east. During takeoff, the aircraft possibly fell through a couple of feet, as they usually do, and, as it entered translation, I saw that the rpm had fallen to 228. I told the pilot to beep up the engines. He hit the beep buttons, but got no response. There were telephone wires at the departure end of the runway and it appeared we could not clear them. I reduced thrust to get back rpm because it was at 226 the last time I looked.

"We got the rpm back and the aircraft began to fly all right. As the wire went under the chin bubble I thought the pilot pulled the stick back and I said to

"A load aboard the aircraft which exceeded the allowable load established by unit policy by 1,965 pounds and the design alternate gross weight by 874 pounds . . ."

him on the intercom, 'Don't pull it up.' He replied, 'You've got it' or 'You're flying it.' I'm not sure if he touched the controls, but the nose came up at that point and I shoved it back down. We cleared the lines to the best of my knowledge and the aircraft suddenly began to fall free at an airspeed of 40 to 50 knots. I pulled it into a flare and looked for an open area, since I had no alternative. I flared hard as I had 40 to 50 knots of airspeed and pulled the thrust to the stops at the top limit to break the fall. The airspeed slowed quickly and we veered to the right. I gave it left cyclic to keep it straight.

"I had a choice of hitting the building or the guy wires of an antenna. We hit the guy wires and the aircraft went into a ditch and rolled over. The engines were still running and I told the pilot to pull the engines to stop if he could find the levers. . . ."

Pilot: ". . . I finally got both engines to stop and got the door off. After the AC was out, I turned to get the battery switch off. Because the aircraft was upside down and mud covered the letters on the switches, I had to hunt for it. Finally, I got it off and I thought the panel was cleaned up as well as I could get it. I tried to go through the companionway to help the passengers, but the load was evidently cracked open, as cases and loose cans were blocking the way. I went around to the back and found the AC helping to get the people off and I started to help. Something was burning and an electrical short was arcing. Fuel was flowing everywhere, but we managed to get everybody out. . . ."

Questions asked AC: "Were you topped off with fuel?"

"Yes."

"Did you check how many people were on board?"

"The crew chief said about 15 to 20. I could see five or six people. I don't know exactly, but I trust the crew chief."

"At what power did the engines top out?"

"No. 2 at 93.6 and No. 1 at 94.0. They were very strong and could pull 830 pounds easy."

"Were you pulling max power at the telephone lines?"

"Yes."

"At the time when you were near the wires and you saw the rpm falling and got it back, was it before or after passing the wires?"

"I got the rpm back before the wires and started climbing at 40 knots."

Chinook came to rest partially inverted

"What power setting did you have?"

"I don't think I exceeded 800 pounds."

"Can you explain what happened at that point?"

"As we cleared the telephone wires, the aircraft felt like it bucked, almost like flying through rotorwash. We started falling through at 40 to 50 knots and I didn't know what was wrong. I flared hard for the open spot."

"Once you were committed to the approach and lined up, did you see or contact any 55-gallon drums, or did the area look clear?"

"I don't think we contacted anything until we hit the guy wires.'"

"What hit the guy wires?"

"We were in a flare attitude and our rear wheels were on the ground and I was driving it to a stop when I saw the wires. The left front rotor blades hit the wires as I put the cyclic to the left to keep from hitting the building."

"Where did you lose control?"

"When we hit the wires. We were going slow and I thought I could stop, but we hit separate wires two times and kept moving forward. I had full thrust pulled and I didn't see the ditch we fell in."

"Were the brakes locked?"

"No."

"Were the swivels locked?"

"Yes, we locked them during the hover check."

Investigation: ". . . Numerous crash rescue vehicles, ambulances and spectator vehicles were at the accident scene by the time the investigation board arrived. Considerable evidence had been destroyed by these vehicles and rescue personnel. Almost all ground markings from the point of loss of the left wheel to the point where the aircraft was at rest had been obliterated. . . . Firetrucks were still foaming the aircraft to neutralize fuel which was leaking from the aircraft fuel tanks. . . .

"The maintenance representative of the board examined the aircraft and interviewed the crew members for structural or mechanical failure that could have contributed to the accident. No such evidence was found. Statements of the crew members all indicated the aircraft had been performing exceptionally well up to the time of the accident. Examination of the engines revealed that the N_2 actuators on both engines were fully extended, indicating the demand for power by the pilot had been satisfied by the N_2 actuators to the limit of their capability. Crew member interviews also revealed there were no compressor stalls or bleed band popping at any time during the flight. . . .

"Investigation was started to determine as closely as possible what load was aboard the aircraft at the time of the crash. The information acquired was incorporated into the DD Form 365F in the aircraft records and a new DD Form 365F was computed by the maintenance representative of the board. From this investigation, the following facts emerged:

"1. Maximum alternate gross weight is 33,000 pounds.

"2. Total aircraft weight prior to loading was 24,239 pounds.

"3. The allowable load that would not exceed maximum alternate gross weight was 8,761 pounds.

"4. Unit policy limited the allowable load to 8,000 pounds for the CH-47A helicopter.

"5. The load aboard the aircraft at the time of the crash weighed approximately 9,965 pounds.

"6. The gross weight of the aircraft at the time of the crash was approximately 33,874 pounds, allowing for the use of 330 pounds of fuel between the time the engines were started and the time the aircraft came to rest after the crash.

"7. The weight of the load exceeded the limit established by unit policy by 1,965 pounds.

"8. The weight of the load exceeded the design alternate gross weight of 33,000 pounds by 874 pounds at the time of the crash.

"Interrogation of the crew members indicated that both the AC and pilot knew that the load exceeded their capabilities before the first hover check was made. Due to the insistence of the officer in charge of the cargo and passengers, the AC elected to attempt a hover in an effort to demonstrate to the passengers that the aircraft was incapable of taking them all. No accurate count was kept for the number of passengers that were loaded initially, or the number that were aboard at the time the decision to take off was made. . . .

"After takeoff, the rate of climb was insufficient to clear the telephone wires and a cyclic climb was initiated at this point by either the AC or the pilot. Due to conflicting statements, the board was unable to determine who started the cyclic climb. The pilot stated that at no time did he move the controls. After crossing the wires, he tried to gain additional rotor rpm through the normal engine trim system and was unsuccessful. He then tried the emergency engine trim system and again was unsuccessful. Due to the position of the N_2 actuators, it is the opinion of the board that when the demand was made for more rpm upon crossing the wires, the N_2 actuators were already fully extended, indicating that the demand for full power was made prior to the wires and, unknown to the AC or pilot, a reserve of power did not exist at the time the AC asked for it. . . .

"I AGREED TO TRY"

"Immediately after touchdown, the aircraft struck a stack of barrels which sheared the left rear landing gear. It continued to slide forward in a straight line until the rotor blades struck two unmarked antenna guy wires stretched across the aircraft's path. White paint from the rotor blades was evident on the sheared ends of the guy wires. Each guy wire consisted of a three-strand twisted steel cable with an approximate diameter of three-eighths inch. . . .

"When the aircraft rolled, the internal cargo broke loose and was the primary cause of passenger deaths and injuries. Interrogation of the flight engineer revealed that a single 5,000-pound cargo strap had been placed across two pallets. The total weight of this cargo was 2,300 pounds and the strap was centered on the load and tied fore and aft. A single 5,000-pound cargo strap was placed across another pallet containing seven bags and weighing 1,540 pounds. This strap was also centered on the load and tied fore and aft, as was a single 5,000-pound cargo strap across two other pallets which weighed 1,930 pounds and 1,000 pounds respectively.

"The board determined that none of the passengers used seat belts. However, due to the size of the cargo that was loaded, it is doubtful if more than 8 to 10 seat belts were available to the passengers. Due to the condition of the cargo when the board arrived, a center of gravity computation could not be made. However, it is the opinion of the board that the aircraft was within c.g. limitations. This opinion was based on the experience of two members of the board, both qualified in the CH-47A."

Analysis: "The cargo loaded aboard was underestimated in total weight and improperly tied down. In an effort to satisfy the desires of the officer in charge of the cargo and passengers, the AC elected not to compute the weight of the passengers the officer wanted to load aboard and elected instead to take on as many as the aircraft, in his opinion, could handle.

"After the takeoff was started, the rotor rpm decreased slightly from 230 (a normal reaction for the CH-47 helicopter) and the pilot increased the rpm back to 230 with the normal engine trim system, using the small power reserve that remained during the hover check. Because of the high gross weight of the aircraft and the prevailing density altitude, the rate of climb was insufficient to clear the telephone wires across the takeoff path.

Photograph shows severed guy wire with evidence of white paint from blade tip

"At the time the cyclic climb was started to clear the wires, the aircraft was just slightly beyond the airspeed that enables it to gain a lift benefit from translational lift. As the cyclic climb was started, the AC increased the thrust which resulted in an rpm loss and, simultaneously, the aircraft decelerated to a point where the benefits of translational lift were lost and began to descend. As it continued to descend, the AC continued to increase thrust, with a resultant continued decrease in rotor rpm.

"The aircraft struck the ground in a slight left slip and the distance required to miss the stack of 55-gallon drums was misjudged. The left rear portion of the fuselage hit the drums, shearing the left rear landing gear. The loss of the landing gear resulted in the loss of rear wheel braking power and the AC was unable to slow the groundspeed. Full thrust had been applied and the rotor rpm had decreased to a point where a little if any braking benefit was received from the rotor system. Although the AC felt that he had control up to the point where the rotor blades struck the guy wires, he, in fact, did not have control due to the loss of the landing gear and the extremely low rotor rpm. The AC and pilot were unaware that they had lost the landing gear.

"As the left front landing gear went over the edge of the ditch, the left side dropped, causing a twisting movement that rolled the aircraft. The internal cargo had insufficient fore and aft restraints and no lateral restraints. As the aircraft rolled onto its left side, the cargo slipped its restraints and either directly or indirectly caused the deaths of five passengers and the

numerous minor injuries sustained by the personnel in the cargo compartment."

Flight surgeon: "The door gunner, crew chief and flight engineer had on no type of restraining device. The flight engineer stated that he was thrown around in the aircraft.

"None of the passengers were seated in the troop seats and none wore any type of restraining device. It is thought that the cargo coming loose was a big factor contributing to the injuries, but the lack of restraint was also a factor.

"The loose cargo in the aircraft impaired rescue operations. Two of the passengers who were killed were trapped beneath the cargo."

Findings: "Crew error in that the AC failed to properly analyze the effects of high gross weight and density altitude on the expected performance of his aircraft in a takeoff configuration.

"A load aboard the aircraft which exceeded the allowable load established by unit policy by 1,965 pounds and the design alternate gross weight by 874 pounds.

"Improper supervision of the crew by the AC in the computation of the weight of the load aboard the aircraft.

"Lack of supervision by the AC demonstrated by inadequate cargo restraint.

"Failure of the AC to recognize the dangers inherent with a cyclic climb while at an airspeed close enough to translational lift that would make the loss of translational lift probable."

Recommendations: "This board recommends that command emphasis be put upon a refresher course of instruction to be presented to both pilots and crew members in the proper computation of load weights, proper restraining procedures, the effects of density altitude on the performance characteristics of heavily loaded aircraft and the responsibilities inherent with the position of aircraft commander."

Indorsement: "Concur with the established cause factors listed by the accident investigation board. Nonconcur with the fact that the investigation board found no probable or suspected cause factors. There is sufficient evidence in this report to indicate that a wire strike by the aircraft as it passed over the initial set of wires was probable. One witness stated it felt as if something hit them and another stated it felt as if someone hit the brakes as they crossed the wires.

"Additionally, the fact that the air traffic controller supervisor sighted a white flash on both sides of the aircraft as the wheels passed over the wires would indicate suspected electrical contact or, at least, a possible discharge of static electricity. Further, the AC stated that the cyclic came back as he crossed the wires and he thought the pilot had taken the controls. The pilot denied touching the controls at any time. Therefore, it is suspected that a cyclic climb was not initiated as described in the board analysis, but that the aircraft attitude change at that point might have been the result of it contacting the wires.

"Safety classes were conducted the day following and 3 days following the accident to refresh all crew members and aviators on standard operating procedures within this unit. At this time, the allowable torque remaining for takeoff during hover and go no-go checks was increased from 50 pounds to 100 pounds to further increase the margin of safety for all takeoffs.

"Refresher instruction was also conducted on the dates indicated on the importance of proper load computation, cargo tiedown procedures, passenger restraint procedures and general enlisted crew member duties.

"At classes conducted for officers, proper pilot techniques and procedures used in dust, high density altitudes and downwind conditions were also discussed. At this time, I also emphasized the responsibilities inherent with the position of aircraft commander to my aviators personally.

"As a result of my investigation into the accident, I have prepared and dispatched a letter recommending the establishment of a CH-47 mission approving authority. . . . The proposed function of this agency will be to screen all CH-47 missions flown in this area in the future, and to appraise and advise those units which consistently request aircraft commanders to violate existing safety precautions and procedures. . . ."

Approval authority: "The findings and recommendations of the investigation board, as amended by the indorsement, are approved."

Closeout letter: ". . . Command supervisory error has been coded as a contributing factor. Refresher instruction and safety classes were conducted the day after this accident. Had a continuing command safety program been in effect prior to this accident, it may not have occurred. . . ."

IFR in DUST

Wreckage of No. 4 helicopter after accident. Note severe damage to cabin area

This photograph, taken during the recovery of No. 2 helicopter, shows tail boom and pylon of No. 3 helicopter extending from dust and illustrates high level of dust density on road LZ

". . . recommend that a policy be implemented outlining the following procedure: When a flight leader or air mission commander suspects a dusty LZ or PZ, a single ship will be instructed to land to ascertain the degree of dust hazard. If it is determined that the area is hazardous for landing a flight in formation, either relocate the PZ/LZ, or make single ship approaches to reduce the hazard of two or more aircraft colliding in IFR conditions resulting from blowing dust"

UH-1H AC: "I was in the left seat at the controls, flying number 4 position in a flight of four. We made our approach in trail formation and the lead ship stayed to the right of the road to keep the dust down until the last minute.

"On short final, nearly at a hover, we started toward the road at about a 45-degree angle. There was a motor scooter on the road just to our left. As my left skid came over the road, I took a quick look to the rear at the scooter and saw that I needed to move forward a little more to clear my tail rotor.

"I looked down and the dust from the ship in front was moving in from my left front and had obscured the ground. I didn't think this would be much of a problem because I could see the ship in front of me plainly.

"As I continued to move over the road, the dust was quickly sucked up toward the main rotor. It was at this point that I went IFR in dust.

"My first reaction was to put it down right there, but I quickly realized that my right skid might not be on the road. If it was not, we would roll to the right because the road dropped off sharply to a low area. I put in right cyclic and started to pull pitch to break out. I was looking for the ship in front of me, but I never saw it. We hit something, apparently the tail rotor of the ship in front. The next thing I remember, we were on the ground and I still had the controls in my hands. I got out and made sure everyone was out."

Questions asked AC: "Were the controls functioning properly at the time of the accident?"

"Yes."

"Why didn't you start a go-around sooner?"

"I was at the very end of my approach and felt committed. My right skid was not yet over the road when I became IFR. I could not put the aircraft down and attempted a go-around at that time. I applied right cyclic to get around the aircraft in front of me. I was concerned about the motor scooter on the road behind me. There wasn't much room and I was afraid of hitting it with my tail rotor."

Report: "The mission of the four helicopters was to insert 24 troops. Preparation for the approach was made by ground personnel throwing smoke to the east of the road. The first three aircraft made successful approaches to the road, although all of them experienced some degree of IFR conditions caused by blowing dust.

"The approach of number 4 was modified slightly to insure clearance from a three-wheeled motor scooter sitting on the road. This vehicle had departed the area by the time the investigation board arrived and its exact location at the time of the accident could never be determined.

"When the left skid of number 4 came over the road, the aircraft went completely IFR in dust and the AC started a go-around. At this time, number 4 contacted number 3. Number 4 then moved in a northeasterly direction, coming to rest in an upright position a short distance away. The main rotor systems of numbers 3 and 4 were displaced from the aircraft and the tail rotor of number 2 was left hanging from the aircraft. The transmission of number 4 was left hanging over the left side of the crushed cabin area and the transmission of number 3 was displaced 180 degrees from its main rotor system. Extensive damage occurred to the airframes of numbers 3 and 4, with incident damage to number 2."

Flight surgeon: "Seven passengers and three crew members were injured as a result of this accident. One was killed, three suffered serious injuries and six had minor injuries. The injuries sustained were primarily the result of the passengers not having restraint devices. Three crew members suffered injuries due to the deceleration forces of the aircraft, despite adequate restraint devices, and also due to flying

IFR in Dust

debris. One crew member sustained minor abrasions due to his hasty exit from the aircraft. All crew members retained their helmets and apparently suffered no injuries due to deficiencies of equipment or improper fitting.

"I recommend . . . consideration be given to having troop passengers wear restraint devices prior to their departure from aircraft."

Board analysis: "The board considered the following possibilities in attempting to determine the exact cause of the accident:

"Environmental: The effects of the dry season have an important bearing on this accident. The heavy dust on the road was either ignored or overlooked by the aircrews on this mission. It is extremely doubtful that this accident would have occurred if the dust had not been present. . . .

"Operational: The AC of number 4 aircraft was unable to cope with the problems set up by a hover in IFR conditions. He found himself boxed in between a motor scooter and number 3. As there were ground guides for this landing and it was executed to an operational highway, a contributing cause must be assessed to the lack of personnel to restrict vehicular traffic at the rear of the LZ.

"Nonrelated: The board found a violation of the unit SOP in that the AC of number 4 came within less than two rotor diameters of number 3 during the approach."

Board findings: "Established: Operation was the established cause factor in this accident in that the AC of number 4 was not able to successfully cope with an IFR condition caused by blowing dust, thereby coming into contact with number 3.

"Probable or suspected: Improper pilot technique in that the AC of number 4 continued his approach, flying into an IFR condition with which he was unable to cope. A probable cause factor must also be assessed to the motor scooter in that it caused the AC to close his formation through fear of striking the vehicle.

"Nonrelated: Violation of unit SOP. . . ."

Recommendations: "That stronger command emphasis be placed on the hazards involved in blowing dust conditions caused by the downwash of rotary wing aircraft.

"That consideration be given to establishing a policy directing that UH-1 type aircraft be landed immediately in the event of inadvertent IFR conditions caused by blowing dust."

Second indorsement: "I have reviewed the report and concur with the findings. I do not concur with the recommendations as stated. The danger of blowing dust was recognized by all the aviators concerned, as witnessed by their statements and actions (i.e., approaches to the ground with the exception of the AC of number 4, because of the added hazard of a motor scooter, could not make his approach to the ground).

"Directing helicopters to immediately land in the event of inadvertent IFR conditions caused by blowing dust is already a policy. . . . I recommend that a policy be implemented outlining the following procedure: When a flight leader or air mission commander suspects a dusty LZ or PZ, a single ship will be instructed to land to ascertain the degree of dust hazard. If it is determined that the area is hazardous for landing a flight in formation, either relocate the PZ/LZ, or make single ship approaches to reduce the hazard of two or more aircraft colliding in IFR conditions resulting from blowing dust."

Reviewing official: ". . . The aircraft commander's lack of experience was also considered as a possible cause factor in this accident. He was administered a postaccident check ride by the battalion standardization instructor pilot who rated his flying ability as outstanding. It is therefore concluded that lack of experience was not a direct cause factor in this accident.

"Units of this battalion have all conducted safety classes on the dust situation since this accident. Command emphasis has been and will continue to be placed on this problem."

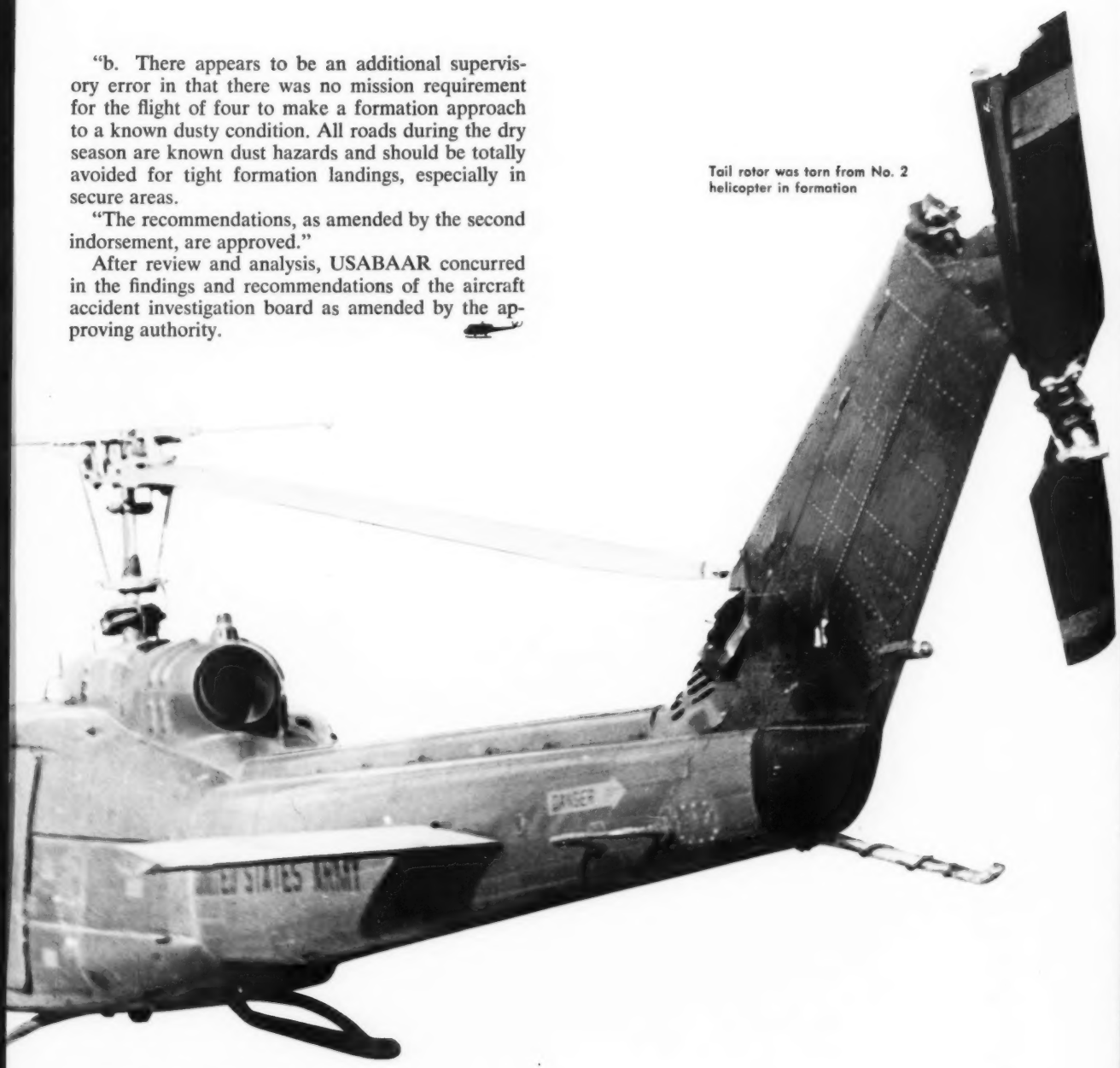
Approval authority: "The findings are approved with the following exceptions:

"a. The established cause factor should read: Pilot error in that the AC of number 4 allowed his aircraft to go IFR in dust before attempting to make a go-around.

"b. There appears to be an additional supervisory error in that there was no mission requirement for the flight of four to make a formation approach to a known dusty condition. All roads during the dry season are known dust hazards and should be totally avoided for tight formation landings, especially in secure areas.

"The recommendations, as amended by the second indorsement, are approved."

After review and analysis, USABAAR concurred in the findings and recommendations of the aircraft accident investigation board as amended by the approving authority.



Tail rotor was torn from No. 2 helicopter in formation

PEARL'S

Personal Equipment & Rescue/Survival Lowdown

Dear Pearl:

Concerning your letter to Major Shader in the December 1969 issue of the AVIATION DIGEST, I believe you misquoted the authority for pilot's clipboard. TA 50-901 does not authorize subject items. If you will research TA 10-100, I believe you will find they are an old Quartermaster expendable item. Change 1, TA 10-100, gives FSN 7520-082-2636.

CW2 Robert L. Cleek
Property Book Officer
21st Avn Bn (Cbt)
Ft. Sill, Okla. 73503

Dear Mr. Cleek:

Thanks for catching our out-of-date information and bringing it to my attention. Further research discloses that SB 700-50, dated July 1969, has superseded TA 10-100 and lists clipboard, pilot's aluminum as FSN 7520-082-2636. The basis of issue is one per aviator on flying status.

Pearl

SPH-4 SPARE PARTS

We have received inquiries from on-the-ball supply personnel in Southeast Asia wanting to know authorizations, Federal Stock Numbers, etc., for spare parts for the SPH-4 helmet. A call to the U. S. Army Support Center in Philadelphia established that procurement of spares for the SPH-4 helmet are currently being negotiated, with expected delivery dates of approximately 1 February-1 March 1970. Spare parts lists and authorizations are presently being completed and will be made available through logistics channels in the near future.

The following letter, though not addressed to Pearl, gives a vivid description of how properly worn protective clothing prevented serious or fatal injuries to two aviators who were caught in an inflight fire. Captain Groves describes the accompanying photographs in his letter. We are grateful for his letter and the photographs and print them in the Pearl's section with the hope they will inspire others to wear all available protective clothing and gear.

Sir:

. . . An aircraft within this group was involved in a serious mishap which resulted in the aircraft's total destruction. The UH-1H was hit by hostile fire and burst into flames at 1,200 feet. The aircraft commander did an excellent job of getting the aircraft on the ground. Flames were all around the AC and pilot

CUT ALONG LINE AND DISPLAY IN PROMINENT PLACE

MARCH

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Thanks to Columbia Pictures Corporation, Miss Janet Landgard graces our March calendar. If you'd like to be around for many more years and see her play middle age roles, use your protective and survival gear wisely and fly, maintain and inspect your aircraft by-the-book. See you at the movies?

If you have a question about personal equipment or rescue and survival gear, write Pearl, U.S. Army Board for Aviation Accident Research, Ft. Rucker, Ala. 36360

in the cockpit and the tail boom was severed on short final. The most remarkable result was that the pilot and aircraft commander survived with only minor burns (1st and 2nd degree). This can be directly attributed to the fact that both aviators wore Nomex flight suits, Nomex gloves and leather boots. The fact that both aviators had their helmet visors down contributed greatly to the protection of their faces.

I have inclosed pictures of the aircraft commander's Nomex shirt and the pilot's SPH-4 helmet. The helmet was blistered, the visor had begun to melt and the microphone had melted. This is an indication of the intense heat that was present. A check of the Nomex shirt revealed that the shoulder harness had melted onto the collar of the shirt. However, the AC did not receive serious burns in this area.

A great deal of money and effort has been expended in order to make protective clothing for aviators. This clothing is available and any man who does not take advantage of it is a FOOL. Nomex makes the difference between walking away from disaster and being burned to death in the wreckage. This is not the only instance where Nomex has saved the lives of aviators within the 11th Group. Regretfully, some lives have been lost because Nomex was not worn.

Captain Edward D. Groves
Aviation Safety Officer
Hq, 11th Combat Avn Gp
1st Cavalry Div (AM)
APO SF 96490

CREW ERROR?

the following article represents the author's views which are not necessarily those of the Department of the Army or USABAAR

Louis H. McKenzie

TOO MANY ARMY aircraft accidents are determined to be caused by crew error.

Crew error may be defined as a crew member (most often the pilot) doing something he should not have done or not doing something he should have. According to this definition, any pilot commits crew error on every flight he makes. The only reason he doesn't get blamed for committing the error is there is not an accident. Flying consists of continuous situations requiring a decision based on judgment by the pilot. Now if we expect anyone or rather everyone to make every decision based on judgment (sometimes it has to be snap judgment) without an error, then aviation isn't practical.

A pilot of an LOH experienced engine failure. He was flying 1,000 feet above a level field. He entered autorotation and turned into the wind. At the termination of the autorotation, he pulled pitch a little too soon and landed hard. The main rotor flexed down and struck the tail boom. The accident board listed pilot error as the cause.

Another pilot of an LOH experienced engine failure, but he was over a wooded area. He zeroed his airspeed just over the treetops and went in. Fortunately, he was uninjured. The accident board listed engine failure as the cause.

Is there really any difference in the causes of the above accidents? Both were initiated by engine failure. True, the pilot of the first should have got the bird on the ground without damage, but he was faced with the decision of when to terminate his descent. He erred in judgment. Therefore, he became a pilot error statistic. The accident board felt he should have been able to get the aircraft on the ground without damage. It was recommended that he be given a postaccident check ride. This check ride was accomplished the next day and the results were that the pilot demonstrated autorotation satisfactorily. The second pilot wasn't faced with the same decisions, once the engine quit. He knew he was going into the trees and have an accident.

The purpose of determining cause is to prevent recurrence. In the two similar accidents above, one commander would have to evaluate his training program and the other his maintenance program, provided they accept the boards' findings.

One of the best ways to reduce aircraft accidents is to eliminate that initial factor that requires the pilot to determine he has an emergency, decide on what courses of action he has and take the most appropriate course. An example of eliminating that initial factor: For years we were plagued with OH-13 and OH-23 fuel exhaustion accidents, until most commanders put a 2-hour maximum flight time on them—regardless of what the fuel gauge read.

It is not the intent here to paint the pilot lily white and say he cannot goof. When he goofs it should be so stated and corrective action taken, but when he has an accident because of an engine failure or other emergency, then demonstrates adequate proficiency to a check pilot, what corrective action is left? If we can eliminate or at least reduce engine failures, tail rotor failures, servo failures, fuel control failures/malfunctions, etc., we are going to have fewer pilot error accidents. Why do we spend so much time practicing emergencies (autorotation) and having accidents while doing so? Because we have too many actual emergencies.

When an aviator is faced with an actual emergency, it isn't the same as a simulated one. Aircraft accident investigation boards would do well to put themselves in the place of the pilot involved in the accident under investigation and determine if the aircraft could have been safely landed (do this before checking the dash 10 and SOP). Make certain all factors are taken into consideration, to include psychological factors. If in the end analysis, pilot error is the cause factor, state what the pilot did wrong, what he should have done and why he didn't do it.

USAASO Sez

The U. S. Army Aeronautical Service Office discusses

Information provided by advisory service
Air traffic control facility operations
How to get a new windsock

Airfield Advisory Service: Some Army airfields provide air traffic control service for a portion of the day and provide airfield advisory service the remainder of the time. Other airfields provide only advisory service at any time. The air traffic control services must be performed by qualified air traffic controllers, as required by AR 95-37.

Advisory service should be performed by either an air traffic controller (MOS 93H, J, K or L) or by a flight operations specialist (MOS 71P). The following should prevent any confusion on the part of controllers, operations personnel and pilots as to the order in which advisory information should be provided.

Advisory service may provide the following (reference FAA 7110.10):

- Wind direction and velocity
- Favored runway
- Altimeter settings
- Pertinent NOTAMs
- Cautionary information

Advisory service may not include:

- Sequence in aircraft
- Clearance to land or depart
- Use of ATC light signals
- Any other control functions

TM 95-200 and FAA 7210.3. Attention Airfield Operations Officers and Air Traffic Controllers:

- What forms do I use to record daily tower activities?
- Do I use local time or GMT on ATC forms?
- How often must control tower equipment be checked?
- What is a "letter of agreement" and how do I prepare one?
- How can I tell if my GCA operators and equipment are performing satisfactorily?

For the answers to these and any other questions, see TM 95-200 (Air Traffic Control Facility Operations), dated April 1969. The purpose of this manual is to provide administrative and operational standards for the operation of U. S. Army air traffic control facilities. This manual provides information and guidance which has never before been available in one Army document.

The TM 95-200 will be used in lieu of 7210.3; therefore, automatic distribution of changes to the FAA Facility Management Manual has been canceled. To obtain your copy of TM 95-200 (Air Traffic Control Facility Operations), requisition it from the AG Publications Center in St. Louis, Mo.

Windsock: Are you getting tired of that darned and tattered airfield windsock? How about getting a new one. If you just need the nylon sleeve, order Windsock FSN 6660-044-1914; the entire windsock assembly to include the nylon sleeve and its pipe support is Indicator, Windsock, FSN 6660-527-7238. Don't just be windy—sock it to supply. Order what you need.

Hold It Tiger, You're Outclassed!

In Vietnam it's always thunderstorm time, and in other sections of the world spring is just around the corner with its menacing thunderstorms. No matter where you are, you're still no match for the champ. Better swallow your pride and do a 180 when you encounter him.

win recognition for your unit!

POSTER IDEA CONTEST

AT THE SUGGESTION of CPT Perry G. Walker Jr., aviation safety officer, Standards Division, Department of Rotary Wing Training, USAAVNS, USABAAR announces a worldwide aviation accident prevention poster idea contest. Anyone can enter and you need not be an artist or illustrator. We need your ideas, not your drawings.

For each poster idea used, the sender's name and unit, as well as the poster he suggested, will be published in the Crash Sense section of this magazine. Here's your chance to make a contribution to the Army aviation accident prevention program and win recognition for yourself and your unit.

Ideas may cover the full range of aviation safety subjects—flying, maintenance, training, supervision, weather, personal equipment, survival, facilities, publications and many others. *All* will be given full consideration and those selected will be published as posters and distributed to Army units around the world.

*Jot your idea down on a card or in a letter and send it to:

Director
USABAAR
Poster Idea Contest
ATTN: Education & Prevention Department
Fort Rucker, Alabama 36360

*Direct communication authorized by AR 15-76.